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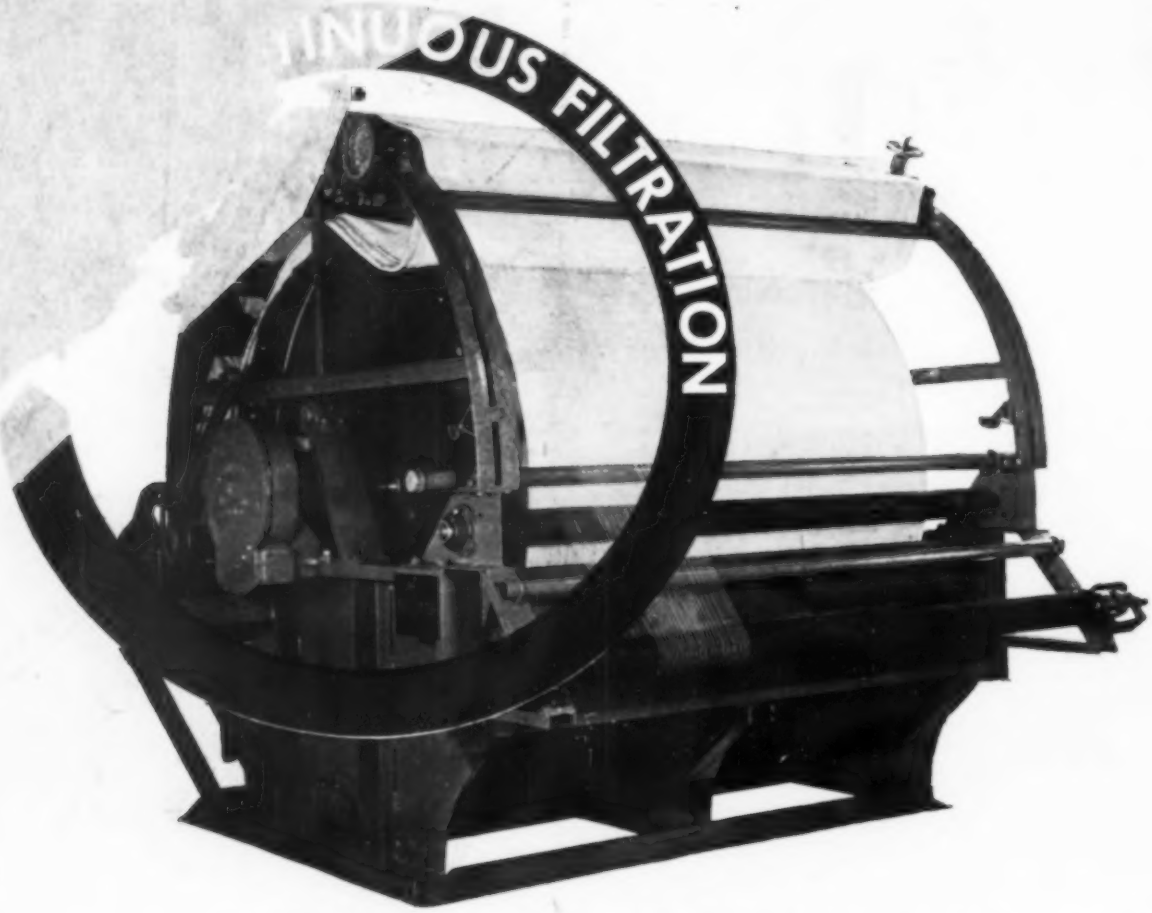
In this issue

24th Annual Review & Forecast Number



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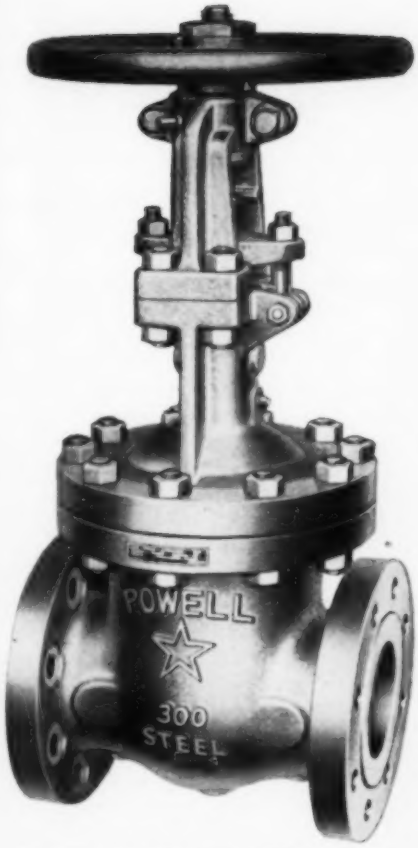

Fig. 3003—Class 300-pound Cast Steel Gate Valve with bolted flanged yoke, outside screw rising stem and taper wedge solid disc.

Fig. 1793—125-pound Iron Body Bronze Mounted Gate Valve. Has flanged ends, outside screw rising stem, bolted flanged yoke, bronze seat rings and taper wedge solid disc. Also available in All Iron.

Fig. 375 — 200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel bronze disc.

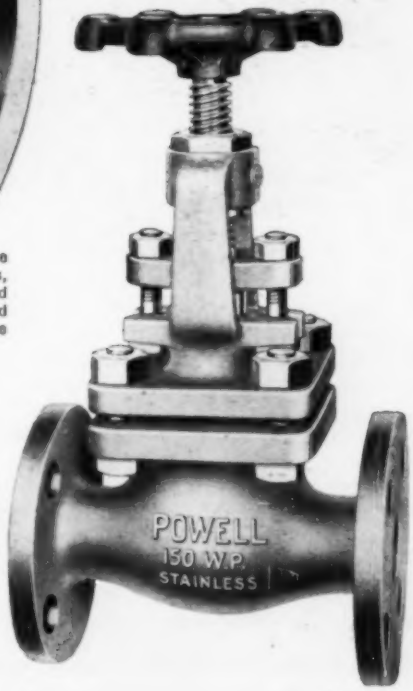

Fig. 1969—150-pound Stainless Steel Gate Valve. Has flanged ends, outside screw rising stem, bolted flanged yoke-bonnet and taper wedge solid disc.

Fig. 1944—Large size 150-pound Stainless Steel "Y" Valve with flanged ends, bolted flanged yoke-bonnet and outside screw rising stem.

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VALVES

WATCHING WASHINGTON

R. S. McBride, EDITORIAL CONSULTANT
J. V. Hightower, WASHINGTON CORRESPONDENT

Scope of synthetic liquid fuels program of Interior Department may be curtailed by cut in amount of funds allocated . . . Priority assistance for obtaining equipment and materials has been greatly reduced . . . Chlorine supply this year will be expanded by the sale or lease of government-owned plants for private operation . . . Styrene plants also are passing to private control . . . Chemical industry opposes lowering in tariff rates . . . Proposal for establishment of research agency to study physical phenomena . . . OTS closes contracts for government-financed research

SYNTHETIC FUELS FACE TEST

If an economy-minded Congress should slash the Interior Department's request for funds to continue its synthetic liquid fuels program, it is believed that the phase of the work relating to fundamental research is less likely of curtailment than the "plant demonstration" program.

In the budget presented to Congress last month, the funds requested for continuation of the synthetic liquid fuels program envisaged the continuation of all phases of that work, authorized by Congress in 1944. However, Interior Department officials were looking for attacks on the program on the grounds that present large scale work by private corporations nullifies any work by the government on a comparable scale.

It is understood in Washington that private industries in this field strongly support continued government studies in research. These spokesmen, Interior Department men say, discourage large-scale work, on grounds that failures in the grand manner make it hard to secure from boards of directors appropriations for further work.

WHY OIT REPLIES ARE SLOW

Foreshadowing further relaxations on exports is the statement of authorities in the Office of International Trade that applicants for export licenses should not be discouraged by failure of OIT to act promptly. Applications which normally would be returned without action because of current quota limitations will not be returned to the applicant where it is possible that favorable action may be taken at a later date. These applications will be held by OIT for further consideration. In such cases the applicant will be notified that his application is being held temporarily without action.

Applicants are asked to wait two weeks before further inquiry. Exporters are reminded that requests for information on the status of delayed cases, or other inquiries, should be submitted in accordance with provisions of Comprehensive Export Schedule 22, Pa. 40.

PRIORITIES SHARPLY CURBED

Receiving little attention when issued a few weeks past, a sweeping amendment to CPA's Priorities Regulation 28 has cut deeply into priority assistance formerly given to manufacturers needing equipment and materials. CPA will no longer give CC ratings for production materials, maintenance, repair and operating supplies, capital equipment, construction equipment or facilities for starting or maintaining any individual plant to alleviate individual hardship. However, CC ratings already issued will continue valid.

Henceforth, a CC rating will be issued only in limited cases to meet needs of the military, public health, and public utilities, as well as veterans' housing requirements.

The axe has completely eliminated Schedule 1 to PR-28, which listed certain "critical" materials, producers of which were entitled to ask priority aid. Schedule 1 included normal butanol, industrial ethanol and methanol from non-food materials, lead, penicillin, rosin, rubber, streptomycin, titanium dioxide and wood pulp.

Two weeks ago Direction 18 to PR-28, (CC ratings for consumers of iron castings and steel) was still in effect. Also, ratings for exports required to support "public policy" still remained.

CAUSTIC SUPPLY STILL SLIM

Scarcity of caustic soda, soda ash and chlorine, which is of worldwide proportions, will contine well into the summer of 1947, according to Department of Commerce estimates. Production of these three basic commodities, although much above 1939 levels, is insufficient to meet heavy requirements. Last year's strikes, causing setbacks in production of steel for containers as well as production losses in caustic manufacture, have aggravated the effect of abnormally high demands.

Contributing to limited caustic deliveries, according to Commerce and CPA officials, has been the shortage of pressure tank cars for moving chlorine. The shortage has been so severe on numerous occasions as to curtail output in electrolytic caustic-chlorine plants. Little relief from this lack of cars is expected before the middle of the year. One producer informed CPA recently that he was suffering a probable daily cut back of 50 tons of chlorine because of the car shortage. Another manufacturer asserted that for the same reason he has delayed a contemplated expansion in production.

CPA Chemical Division officials say they will not issue a direction aimed at assuring users of caustic soda a delivery in 1947 of at least 65 percent of the quantities they obtained last year. Voluntary allocation by producers will be followed.

GOVERNMENT PLANTS AIDING

The scarcity of caustic and chlorine would be appreciably worse than it is, were it not for the fact that the government-owned electrolytic plants, aside from the Chemical Corps

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U. S. STONEWARE

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arsenals, have been bought or leased and are in production totaling about 460 tons per day of chlorine. This group of plants consists of those at Memphis, Tenn., purchased by Heyden Chemical Co.; Velasco, Tex., bought by Dow Chemical Co.; Las Vegas, Nev., leased by Stauffer Chemical Co.; and Natrium, W. Va., bought by Columbia Alkali Co.

Around July an additional daily output of 240 tons of chlorine is expected to come from revamped facilities at Lake Charles, La., leased during the war by Mathieson Alkali Works. Southern Alkali has leased and is converting that plant to manufacture of caustic and chlorine.

As to the caustic-chlorine equipment in the Chemical Corps arsenals, leases of the Pine Bluff, Ark., facilities to Diamond Alkali Co., and those at Denver, Colo., to Colorado Fuel and Iron Co., were expected to be announced early in February. Only the plant at Huntsville, Ala., was in production on February 1. Diamond Alkali, lessee of the equipment at Edgewood, Md., may get into production early in March. Total chlorine capacity of the four arsenals is around 300 tons per day.

ALKYLATE UNITS MOVING

War Assets Administration engineers believe that a goodly number of government-owned plants for producing alkylate, an iso-octane component of 100 octane aviation gasoline, will yet be sold to chemical manufacturers. Several have been so marketed. Latest was the sale, a few weeks ago, of the plant operated during the war by the Pennzoil Co. at Oil City, Pa., to the Koppers Co. Koppers bought the unit to convert it to the manufacture of alkylated aromatic chemicals.

Previously, the Oronite Chemical Co., member of the Standard Oil Co. of California, took a long-term lease on the unit formerly operated by Mohawk Oil Refining Co., for "manufacture of other chemicals." Also, Utah Refining Co., affiliate of the Standard Oil Co. (Indiana), purchased from WAA its previously leased alkylation unit in order to operate it "for other purposes."

Negotiations for the disposal of several other units are under way. There are prospects that a few may be dismantled and moved to China and Sweden.

STYRENE UNITS ALSO SELL

Like the alkylation units in the government's petroleum refining holdings, the five styrene units in the government-owned synthetic rubber system have proved to be of considerable interest to manufacturers of chemicals. Sale, last month, of the styrene plant at Velasco, Tex., to Dow Chemical Co., the wartime operator, was the third such installation to be sold. Dow continues to furnish some of the product for synthetic rubber manufacture, but is understood to be channeling the major part into chemical lines.

Previously, the styrene units at Texas City, Tex., and Kobuta, Pa., had been sold, respectively, to Monsanto Chemical Co. and Koppers Co., the former lessees of the plants. Those companies likewise are furnishing a portion of their production to rubber and are diverting the remainder to chemicals. Koppers is installing new facilities at Kobuta to produce polystyrene.

Remaining are the styrene plants at Los Angeles, Calif., and Institute, W. Va. Dow Chemical Co. is still running the Los Angeles unit as part of the rubber program. The Institute plant, leased during the war by Carbide and Carbon Chemicals Corp., is idle.

SOME WAY OUT

One of the most difficult problems with which Congress has been struggling, portal-to-portal pay, will not be solved even when the first bills have passed and been approved by the President limiting for the future the extent of back pay suits in this category. No one thinks that a single legislative measure is going to be enough. But it seems absolutely certain that some way will be found to escape from the multi-billion dollar flood of demands.

Seriously feared, though much wanted, is some form of retroactive legislative interpretation of what Congress meant when it sought to prevent chiseling employers from making time demands on workers without payment and without contract right. The fear is that any form of interpretation which purports to be retroactive may set a dangerous precedent. Yet the need for some such effect is clear to all parties, especially including those who have at heart the long-term good of organized labor.

TO PROTECT CUSTOMERS

Molasses control would normally have prevented Allied Molasses Co. from doing current business because of alleged violation of distribution rules. But the Department of Agriculture found that strict application of a suspension order was "working an unreasonable hardship on persons who are necessarily solely dependent upon that company for blackstrap molasses or for products derived therefrom." Hence this company has been given permission to renew activity, limited to such business as is essential to protect the innocent customers.

"AGREEMENTS" VERSUS ITO

Partisan politics probably will enter international affairs most violently through discussion of trade agreements and of the proposed International Trade Organization. The establishment of ITO will touch off a new and perhaps even more bitter controversy because that State Department creature means that Congress must vote still further surrender of American sovereignty in trade control for the cause of increased international goods movement.

The present schedule of Reciprocity Committee hearings, an 18-nation gathering for negotiation, and the formulation of 18 new trade agreements, has not yet been disturbed. It is too much for the proponents of that program to expect that some of the more radical protectionist members of Congress will not propose and perhaps advance some drastic legislation that will cut down on the authority of the State department to dicker and the President to order more extensive tariff reductions. Foreign representatives in Washington know that the way is not smooth. It is reported that they will enter the forthcoming negotiations with less than complete confidence in getting U. S. adoption of the agreements reached. This greatly weakens the State Department in its trading.

TRADE ORGANIZATION DELAYED

The Department of State has very discreetly decided to present to Congress the proposed charter of ITO under United Nations sponsorship only after the 18 trade agreements have been signed, sealed, and delivered. Critical Congressmen know this. And in the decision they find a megaphone through which to shout their comments that Congress is being ignored and that the State Department is trying to override legislative authority by withholding proposed international agreements until after they have gone beyond the range of Congressional review and change.

Not the least of General Marshall's problems in dealing with Congress will be a decision both as to policy and procedure in these trade matters. The effect of these on process industry probably will not be felt to any great

extent for several years, until exportable surpluses are developed in other nations to be shipped into the United States in competition with our production. But this delayed effect of present tariff changes is not persuading to silence the critics of the trade agreement program. In fact it seems to stir them to even more violent attack. All of this, of course, does not obscure the fact that a vast majority of Congressmen of both parties now want the United States Government to take all steps reasonably possible toward elimination of the major barriers to international trade for both United States imports and exports.

TARIFF HEARINGS FRIENDLY

CONCLUDING oral hearings in Washington, last month, on domestic tariffs on imports of chemicals and allied products were held in an atmosphere of good-will on the part of both the representatives of the chemical industries and government committee holding the hearings. Respect for views of parties on both sides of the table characterized the hearings.

In general, requests by chemical manufacturers that existing tariffs not be lowered were based on two main points: (1) American industries must be protected in order to maintain production of critical and strategic materials if and when another "national emergency" occurs, (2) at this time there is no information as to probable manufacturing costs of foreign competitors in the next few years. Several companies urged that no action be taken on tariff changes before a survey of foreign manufacturing costs can be made.

Observers at the hearings commented on the evident efforts of the committee to secure facts from domestic manufacturers as to production costs at home and abroad. Committeemen indicated that these differentials are likely to be a decisive factor in our sparring with foreigners next April.

PAPER CHEMICALS LIMITED

PAPER authorities in the Department of Commerce say that the major chemicals required for the manufacture of pulp and paper will be limited in supply during most of 1947. Although salt cake and sodium silicates probably will not be of concern, caustic and chlorine will remain below needs. In general, pigments should ease, but availability of titanium dioxide is not expected to meet demand this year. Synthetic resins, in great demand for paints and plastics, will likely remain scarce during 1947.

On the brighter side of the picture, corn starch should be ample. Movements of tapioca from the Netherlands Indies will probably increase. Casein supplies, short at present, are expected to improve materially through higher domestic production and expanded imports from Argentina. After the 1947 first quarter, rosin is believed to be in appreciably better supply because of the outlook for a good crop and increased output of wood rosin. Supplies of aluminum sulphate are believed ample.

Demand for chemicals for pulp and paper production should be somewhat higher than in 1946, on the basis of Department of Commerce estimates. It is expected that the output of paper and paperboard will reach 20 million tons this year, an increase of 5 percent over the 1946 record production.

ATOMIC INSTITUTE PROPOSED

ESTABLISHMENT of a $20,000,000 research agency to study fundamental physical and biological phenomena has been proposed jointly by the National Bureau of Standards and U. S. Public Health Service to the Atomic Energy Commission. Such laboratory probably would be placed at Bethesda, Md. in order to facilitate cooperation with the nearby principal laboratories of Public Health Service and convenient participation in operation by the Bureau.

The Commission apparently has received this proposal with favor, but not undertaken to act on it, nor on other new projects, prior to confirmation of the Commission membership by the Senate. It is also rather expected that final decision regarding this laboratory may be somewhat affected by the size of the research budget which Congress decides to give the Commission for its next fiscal year beginning in July.

If set up as proposed, the new laboratory would include a uranium pile for the preparation of various fission products and for the study of energy and reaction controls. Many of the products would be used by Public Health in its own investigations, and presumably also with many cooperating medical and biologic institutions. At least $3,000,000 would be required for the uranium pile and at least as much more for initial laboratory buildings. The total laboratory investment would, of course, not be made during the first year; but as new installations decreased in cost, the operating expenses and payroll would increase over a period of several years.

FEDERAL GOVERNMENT RESEARCH

BOTH the scope and the budgetary support for future government research hinges on decisions not yet reached by the staff of the President's Scientific Research Board. That agency is making a reappraisal of the spending of about $1.5 billion per year currently being disbursed on one form or another of so-called "research and development effort." If one adds Manhattan Project the figure is even higher. And at the moment the President's advisors appear quite confused as to the relative urgency as well as to the relative importance of many of the major parts of the programs which they seek to review.

The first step to be made by the staff of the Board is a review of the authorizations, the organization, and the size of the spending in different agencies. Functional classification is also being undertaken in order to bring together, for example, all research bearing on public health and in another group all bearing on preparedness and national defense. Then also the Board is trying to decide what is a reasonable division between the civilian and the military purposes, after it determines what the total budget should be. And finally it is confronted with the problem of deciding how much of the work it to be done in the government establishments themselves and how much should be undertaken by contract outside.

A frank and extremely open-minded approach is being made by the government staff serving the Board. One of its spokesmen has pointed out very frankly both the pros and cons affecting several of the major theories of research disbursement. It is evident that the hoped for policy-making report from the Board will not be ready in the early spring as first planned.

RESEARCH FOUNDATION BILL

ALL of the confusion as to what to do regarding budget for research already under way seems seriously to jeopardize the plan of establishing the proposed National Research Foundation. The White House still insists, apparently quite sincerely, that the establishment of such a Foundation is much desired and even confidently expected during 1947. A modification of tactics may occur. If so, the present confusion may be used as an argument for a permanent coordinating agency like the proposed Foundation.

Perhaps only Mr. Truman personally knows whether the prestige of Presidential influence may be back of that argument. And many Washing-

As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

Photo by courtesy of General Die Casting Corp., Oakland, Calif.

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ton observers doubt whether the President has yet had time to go very deeply into these matters of tactics, perhaps not even into the more simple questions of basic policy. Certainly one would be quite foolhardy to place any bets on the early establishment of the Foundation.

JUSTICE AFFECTS WAA SALES

WAR ASSETS continues to wrestle with a dilemma in its efforts to sell the more costly surplus plants. That dilemma consists of the fact that on the one hand, only the big companies are in a position to buy the large plants, and on the other hand these companies, precisely because of their size, are deterred from trying to buy because of fear of rejections by the Justice Department. Last year, the "majors" bought or leased only 24 percent, on the dollar basis, of the disposals.

Justice Department officials admit that companies that might otherwise spend time and money involved in negotiating for surplus plants hesitate to do so because such companies want to give Justice no impression that they contemplate expanding their positions in their fields of manufacture. Such firms feel that where their own bids probably would be opposed by bids from new or small companies, they might as well refrain from the competition. War Assets had hoped last year to dispose of large plants to "multiple tennant" groups, but has found few of the smaller producers interested in becoming bedfellows.

OTS INDEX ISSUED

ORIGINALLY scheduled for release in December, the first index of material in the weekly Bibliography of Scientific and Industrial Reports was off government presses last month. Covering all reports and microfilms relating to domestic and foreign developments, the index extends from the first issue of the Bibliography to June 28, 1946. The price is 50c, either to subscribers or non-subscribers of the Bibliography. Next issue of the index, covering July, August and September, 1946, has gone to the presses.

This index is a subject reference to abstracts contained in Vol. 1 of the Bibiliography, and cites the page numbers and report numbers referred to in the weekly issues of that publication. The reports indexed have been received from civil and military agencies of the government and from cooperating foreign governments.

Office of Technical Service officials point out that the index refers to every chemical and all chemical manufacturing processes and equipment which receive more than a passing mention in the original reports. In those instances where a report deals with a large number of chemicals, it is listed under the generic term "chemicals," but references to the individual chemicals in the report are contained elsewhere in the alphabetical list under the name of the specific chemical.

IRDD CONTRACTS MADE

OFFICE of Technical Services through its Industrial Research and Development Division closed before the beginning of February, about a half dozen contracts for research to be financed by Uncle Sam. This group will utilize $200,000 out of the total million-dollar fund which was made available by Congress for this fiscal year.

The closed contracts deal with powder metallurgy, ramie fiber, dimensional standardizations in construction, and the technologic development of several building materials. None thus far closed are strictly chemical or chemical engineering in nature, though some approach closely to process industry projects. A number of pending projects which seem likely to result in contracts are much closer to chemical enterprise.

IRDD officials believe that they have now set a pattern for contracts and established a departmental policy. Thus the next job is to negotiate more contracts from the large number of pending applications that have probable merit within their field. Far more applications are pending than could be financed with the remainder of the million-dollar fund. Hence, some projects probably to be approved will have to wait for funds until July 1 when next fiscal year's money becomes available.

FODDER FROM WOOD WASTES

FOREST SERVICE officials in the Department of Agriculture were preparing to go before Congress this month to ask funds for construction of a semi-commercial plant intended to carry forward on a larger scale an investigation of the conversion of wood wastes to fodder yeast. In 1943 the Forest Service began a laboratory study of the subject at Madison, Wis.

Officials claim no basic new discovery in the process. Conversion of wood into sugars by hydrolysis, followed by growing of yeast on the sugars, has been practiced commercially in Europe, principally in Germany, for a number of years. The Forest Service argument is that there have been recent improvements in technical details sufficient to warrant further development work on a scale large enough to establish the economics of using the process in this country, as a source of supplementary high-protein, high-vitamin B stock feed.

MINOR NEWS GLIMPSES

Palm oil needed by domestic tinplate manufacture this year may be more plentiful than International Emergency Food Council allocations would provide this country from the Portuguese colonies. The Department of Agriculture has announced negotiations with Belgium for palm oil from her colonies in exchange for a like amount of domestic oils from this country.

Government salary scales may be revised in the upper grades as Civil Service Commission executives are urging that Congress remove the old $10,000 ceiling on salaries for such civil servants. Now that Congressmen themselves get $15,000 there is some chance that top-grade scientists, engineers, and other professional men may be granted a more attractive top salary.

Rocket research programs on a vast scale frequently come to the attention of chemical producers asked to supply huge quantities of chemicals to serve either as combustant or oxidant. Actual willingness to buy is far less than the inquiries for chemicals might indicate. Top military officials do their estimating only in most general language.

Rubber compounders again have a freedom of choice regarding the quantities of natural rubber and various synthetics which may be used in most products. Authority to accept delivery of natural rubber must still be obtained from CPA, however. Thus the choice as to which end product will get the limited supply is an industry decision. But the total still is officially limited.

Aerosol bombs for control of the common cold have been so highly publicized in the popular press that a strong warning statement was issued by Public Health Service. The proposals are not criticized directly. But warning is issued that this new use of chemicals is still in the experimental stage and far from proved successful. The authorities are, however, encouraging further development.

CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 FEBRUARY 1947 SIDNEY D. KIRKPATRICK, Editor

THE CHEMICAL ENGINEERING OUTLOOK

CHEMICAL engineers have more reason than most people to be optimistic about the future. They are part of a continuing advance that will not be stopped short of a more paralyzing recession than even the most pessimistic economist has dared to predict. Their services are sorely needed in the process industries to carry forward the large scale exploitation of the new products and processes that have had only laboratory or pilot-plant development during the past six years. From the standpoint of the national economy, their technology can contribute most to improve productivity—to produce more goods at lower costs—and thus to put a stop to the suicidal spiral of wages and prices.

To look realistically at the facts and factors that will largely determine the chemical engineering outlook is the purpose of this twenty-fourth annual review number. In the following pages the broad outlook for American business as a whole is first appraised by qualified economists who are constantly concerned with the study of such trends. Next the international situation is summarized and reports presented from trained observers in the principal industrial capitals of the world. Finally, the outlook for commodities, for both the raw materials and finished products of chemical industry, is reviewed by *Chemical Engineering* editors in the light of current trends in production and consumption. All this is to the end of helping to meet the problems that lie ahead for the process industries.

We know there will be a continuing shortage of technical manpower—particularly in the junior brackets that would normally have been filled by recent graduates. Most chemical engineering equipment and many materials are still scarce and it will take most of 1947 to catch up with deferred demands and current needs. Meanwhile the better balancing of inventories with production and sales must soon be attained if we are to regain and improve the overall efficiency of our operations. This is no time to be lulled to sleep by today's big backlog of unfilled orders. Competition is coming; in fact, it is already beginning to make itself felt in several closely related fields.

There is cause for concern, too, with the factors that lie outside the chemical engineering province and influence. Labor is one of these for chemicals are so closely integrated into so many different industries that work stoppages and unreasonable wage demands can drastically affect production and distribution. Further rises in most prices will penalize our progress by increasing costs and slowing up new construction and modernization projects. And it is the heavy and durable goods industries that must take up the slack in consumer goods as our economy shifts back to a better peacetime balance.

Such is the chemical engineering outlook—a combination of opposing forces here and abroad that cannot readily be resolved into a balanced equation or working formula. But it is to the chemical engineer's lasting credit that resourcefulness based on research and sound engineering, backed by aggressive and progressive management, has always kept the process industries at the head of the procession. The growth of the chemical engineering field will continue at a more rapid rate than the over-all industrial growth of this country as long as we are willing to accept the challenge of such leadership.

Sidney D. Kirkpatrick

THE ECONOMIC OUTLOOK:

What's Ahead for American B

Are we in for a bump or a slump, a rise or recession? Here are the views of trained observers who hold that a lot depends on the smoothness with which the economy shifts in emphasis from non-durable to durable goods. Chemicals stand both to gain or lose in this process.

JOHN D. WILSON

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DEXTER M. KEEZER

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SELDOM has American business entered a new year with such a mixture of favorable and unfavorable factors confronting it. The war created a heritage of needs that in themselves must require a number of years of high employment and heavy output to fill. Yet the first year of adjustment to peacetime conditions has left the economy twisted and distorted in numerous respects. The more serious of these kinks must be ironed out during the coming year, and it is not unlikely that business in general will take a dip downward in the process. But to foretell at this time the degree and duration of such a dip is almost impossible. For here events of the next several months—including those on the labor side—must be of critical importance.

It is helpful in assessing the future of business to see where current production is flowing. This is best done by examining the gross national product, which is the total value of all goods and services produced. The gross product reached a peak of about $208 billion during the war. Strikes and reconversion pains dragged it to a low rate of $182 billion in early 1946. But by the final quarter of this year, output had sufficiently recovered to lift the gross product above $200 billion (part of this increase, of course, merely reflects higher prices). Moreover, the distribution of the national product among various broad consumer groups had changed radically from the war period, as shown by Table I in which the figures represent an estimate of the annual rate in billions of dollars.

As is apparent from the table, both consumers and business have stepped into the breech created by the swift descent of government spending. It was the consumer, however, who first took the initiative, and the past 12 months are likely to go down in business annals as the year of the consumer powered boom. For the immediate upsurge in consumer expenditures after V-J Day strengthened and activated the decision of business to lay out large sums on expansion of facilities and the rebuilding of inventories. Unfortunately, however, this general advance has been accompanied by a series of developments that has left the economic structure in a position that can hardly yet be regarded as stable.

Three of these faults in the economic structure may prove of critical importance to business in 1947: A lopsided pattern of consumption emerged in 1946, largely as a result of limited supplies of durable goods; inventory accumulation has been encouraged to

Table I—Estimated Distribution of Gross National Product

(Annual Rate in Billions of Dollars per Year)

	2nd Quarter 1945	4th Quarter 1946	Net Change
Total Gross National Product	208	204	−4
Consumer expenditures	102	135	+33
Non-durables	62	81	+19
Durables	7	17	+10
Services	33	37	+ 4
Business expenditure for investment	7	33	+26
Equipment	6	14	+ 8
Construction	2	10	+ 8
Net change in inventories	−1	9	+10
Excess of exports over imports	−1	3	+ 4
Government expenditures	100	33	−67

Source: 1945, Department of Commerce; 1946, McGraw-Hill Department of Economics, preliminary estimate.

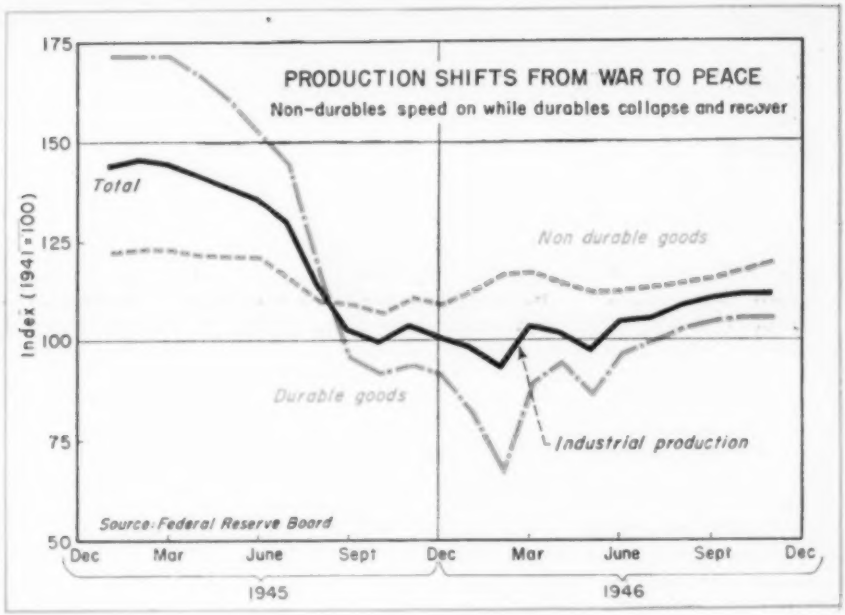
n Business

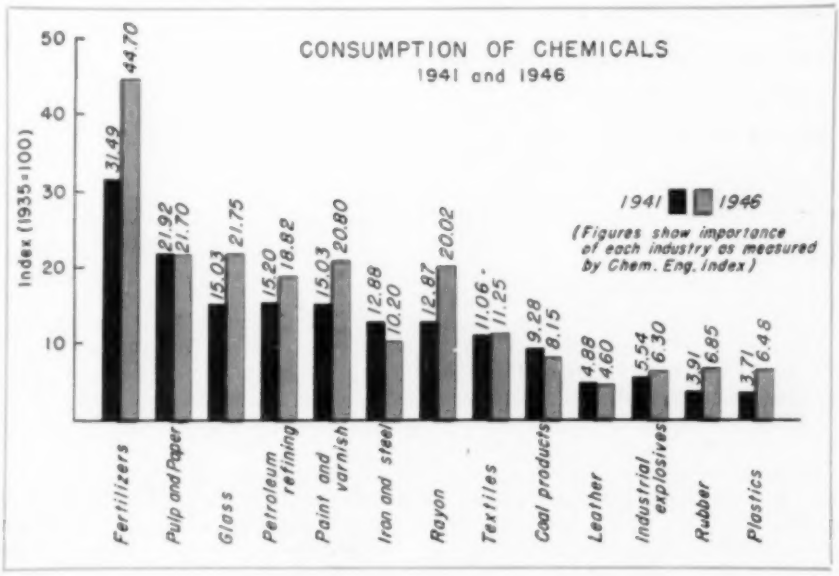
move ahead at a swift and unbalanced pace; and prices have climbed rapidly and unevenly to a level that in many instances is not likely to be maintained. Finally, the necessity to work out a new set of bargains with labor cannot help but cloud the outlook for a wide range of business.

Consider first the growth of production and consumption over the past year. The call of consumers for increased supplies after V-J Day could be met initially only by the non-durable industries. Apparel, textiles, foodstuffs, many luxury lines, and a number of the chemical processing industries were able not only to maintain production but in many cases to expand it. Altogether expenditures on non-durables rose in first half 1946 to more than a fifth above the level that might have been expected from an examination of the pattern of consumer spending in the past.

Meanwhile, reconversion problems, serious strikes, and (partly as a result of strikes) bad shortages in the supply of basic materials held back the output of durable goods. Not until after mid-1946 did production of durables as a whole move above the 1941 level, a fact shown in Fig. 1. And even then, output of some of the most important items (automobiles are the outstanding example) dragged along at a much slower pace than producers or consumers desired.

Many of the barriers to an expanded output of durables have now been overcome. Automobiles are rolling off assembly lines at a pace that approaches that of 1941, and except for refrigerators and sewing machines, production of most household appliances far exceeds the prewar peak. Over coming months output of consumer durables should be further extended. But as consumers turn to these durable commodities they must inevitably cut their spending for high priced apparel, foodstuffs and other items.





Chemical Engineering Indexes
For Industrial Consumption of Chemicals
1935 = 100

	1939	1941	1942	1943	1944	1945	1946
Fertilizers	25.13	31.49	37.33	40.12	39.76	42.21	44.70
Pulp & paper	16.52	21.92	20.51	19.05	18.87	19.44	21.70
Glass	12.51	15.03	15.91	18.80	19.93	19.64	21.75
Petroleum refining	13.45	15.20	14.43	15.56	18.10	18.71	18.82
Paint, varnish and lacquer	10.66	15.03	14.35	15.40	16.71	17.37	20.80
Iron, Steel	8.21	12.88	13.32	13.49	13.33	11.96	10.20
Rayon	9.08	12.87	14.93	15.53	16.81	18.38	20.02
Textiles	7.89	11.06	11.97	11.43	10.53	10.30	11.25
Coal products	7.17	9.28	9.54	9.47	10.05	9.41	8.15
Leather	4.16	4.88	4.88	4.56	4.25	4.54	4.60
Industrial explosives	4.53	5.54	5.73	5.52	5.06	5.36	6.30
Rubber	2.79	3.91	3.00	3.00	3.00	4.55	6.85
Plastics	2.05	3.71	4.36	4.80	5.24	5.75	6.48
TOTAL	124.15	162.80	170.26	176.73	181.64	187.62	201.62

THE ECONOMIC OUTLOOK

Still another factor that must tend to curb the ability of consumers to take goods from the market is the swift advance of prices. The price of necessities climbed more rapidly in 1946 than at any time since 1917, and at the year end consumers were paying out about 18 percent more on living costs than had been the case 12 months earlier. Food prices jumped more than a third, and the cost of clothing rose a sixth. Of the items that bulk large in household budgets, only rents have remained fairly stable.

Most of this price advance occurred after mid-1946, with the cost of living rising 15 percent since June. When these higher prices are lumped with a 7 to 10 percent increase in supplies available to consumers, it is apparent that consumer incomes will have had to be considerably expanded if some items are not to pile up on dealers' shelves. But wages and salaries (which constitute the bulk of mass purchasing power) increased only about 6 percent during the June-Dec. period. This gap between consumer incomes and the higher cost of an enlarged supply of consumer goods is one of the most serious distortions that developed in 1946.

The rise in prices has touched all business, as well as the consumer. Farm prices have led the parade upward (see Fig. 3), thereby pushing farm incomes to a new high. And Table II lays out the advance that has occurred since June in various groups at wholesale. There it may be seen that industrial prices have climbed more than 17 percent.

The expectation of a general advance in prices after mid-year encouraged business to speed up the process of restoring its stocks to a level consistent with its heavy peacetime activity. The result has been a substantial volume of output flowing not to final consumers but into inventory. Indeed, the table on the gross national product shows inventories in the last quarter to have been increasing at an annual rate of about $9 billion.

How long this process of inventory accumulation will continue is uncertain. At least part of the unusually large "goods in process" inventory has been forced upon durable goods producers by shortages of materials and parts. Moreover, the ratio of inventories to sales still is considerably below the level of past periods of prosperity. Nevertheless, the building of stocks is almost certain to come to an end some time in 1947. When it does, a sizeable chunk of demand will have disappeared.

Table II—Advance in Wholesale Prices, June to Dec., 1946

(100 — Week of V-J Day in 1945)

	June 29th	Dec. 28th	Percent Increase
All Commodities	106.8	132.3	23.9
Foods	106.7	149.7	40.3
Hides and leather	104.5	144.6	38.4
Textiles	109.5	134.5	22.8
Metal and metal products	106.5	127.8	20.0
Building materials	110.6	131.2	18.6
Chemicals and allied products	101.7	132.3	30.1
Housefurnishing goods	104.2	113.5	8.9
All commodities other than farm products and foods	105.3	123.8	17.6

Source: Based on data issued by Bureau of Labor Statistics.

All these facts suggest that as business enters 1947 it must contend with (1) a consumer expenditure on non-durables that may have to give way as supplies of durables expand; (2) a new price level that effectively cuts the purchasing power of the average consumer; and (3) the likelihood of a decline in business spending on inventories. The combined effect of these developments is likely to be felt principally (and initially) by such non-durable lines as textiles, apparel, foodstuffs, and most luxury items. These producers must either cut prices or reduce output, and under current conditions they probably will do both.

As a matter of fact, this process already is under way. Farm prices reached a peak in October, when the index touched 273 (1910-14 = 100). Today it rests around 260. Government supports promise to hold farm prices at 200 to 210 for the index, and a good crop in 1947 might drag them down to that level.

Still other straws in the wind are department store sales and purchases. These merchandisers are now selling less than they were a year ago, and many retailers have already begun to cut prices at the expense of profit margins. In the face of such trends, department stores have moved to curtail sharply their own buying for inventory.

The chemical industry of course must eventually feel the effect of any reduction in non-durable output, just as it benefitted from the extraordinarily high rate of activity in 1946. Textiles, leather, and rubber are indusiries that sometime in coming months, might be expected to move down from their record peaks of recent months. These accounted for about a tenth of the chemical consumption in 1946. Moreover, although the inevitable decline in farm incomes should still leave the farmer much better off than in prewar days, it may halt the advance in the use of fertilizer, which absorbs another fifth of the over-all chemical output.

But more than a fourth of the chemicals turned out in 1946 flowed into industries producing durable goods or into construction. These are markets for such important chemical processing lines as paints, glass, steel, and some of the plastics.

The extent to which a turn down in the non-durable may affect the demand for durable products is one of the most difficult questions facing the business analyst. Normally a business letdown tends to feed upon itself. But the current backlog of demand for most heavy goods is so great that many producers may be called upon to expand, rather than contract, output during 1947.

Firms turning out durable goods for consumers are the most likely to face this pleasant prospect. Buyers probably will continue to queue up for automobiles, electrical appliances, and many household furnishing. But these have been accounting for less than half the total outlay on durables. Construction of housing and plant, together with the output of new equipment for producers, have formed an even larger share of the national product.

Equipment—Construction

Here the outlook is less clear. Skyrocketing costs threaten to narrow the market for new housing and have caused some companies to postpone outlays for new plants. Moreover, any business downturn, even if it be mild, is likely to introduce a streak of caution with respect to equipment expenditures. But even with hitches such as these, it is difficult to see how demand in these important areas can fall substantially below the level of today, providing the labor problems of the next several months are surmounted successfully.

Indeed, it is within the durable goods field that labor developments over the next several months will exercise their most decisive influence. The most militant union strength is organized in some of these basic industries. A lengthy work stoppage in steel or the other metals could seriously curtail output of many durables throughout 1947. And strikes in automobile or electrical equipment industries would reduce employment and output at just the time it is likely to be most needed to offset declining activity among the non-durables.

Much in the outlook for business in 1947 therefore hinges on management's success in working out a satisfactory set of new bargains with labor. Either strikes or a new wage level that requires a further advance in key industrial prices will deepen any dip in business. In the absence of such adverse developments, durable goods and construction should prove a source of considerable strength for business, at least until late in 1947. And as this is written, the chance of avoiding domestic labor conflicts appears better than at any time in recent months.

There are still other portions of the national product that can be expected to hold firm this next year. Government spending on goods and services should not fall much below the $33 billion rate of the last quarter, with increased state and local budgets offsetting much of the proposed cut in federal outlays. Moreover, exports probably will expand beyond the $10 billion shipped abroad in 1946. Only a small portion of our foreign loan commitments has as yet been expended, and the needs abroad remain enormous.

Decline and Readjustment

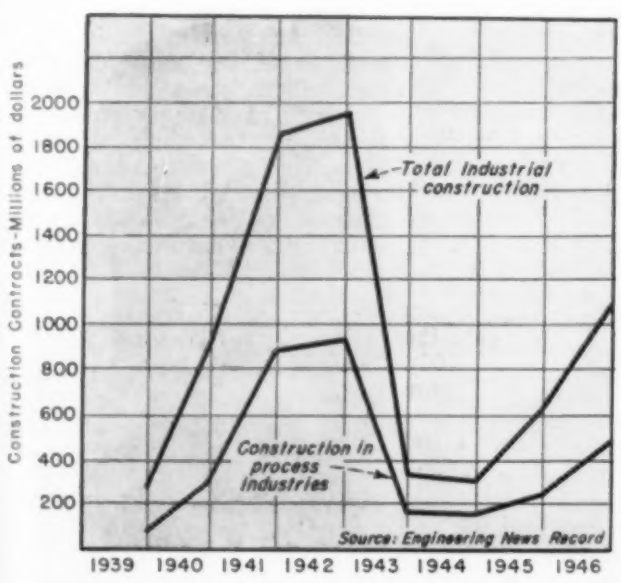
Thus the only links in the chain of demand that now show clear signs of weakness are consumer outlays on non-durables and business expenditures for inventory. A decline in these portions of the gross product (which might be expected to start in the second or third quarter) may in itself force a reduction in industrial production of 10 to 15 percent. This would push the Federal Reserve Board index of industrial output back to the level of first-quarter 1945. But in contrast to a year ago, the non-durables will have replaced the durables on the weak side of the list.

Perhaps the most important result of any such dip in business will be the healthy realignment of prices—particularly those prices that loom large in the cost of living. Barring the unforeseen in the way of poor farm crops, a decline in the average of food and clothing prices appears almost a certainty during 1947, and the pay envelope of the worker ought to carry more real goods in it a year from now than it does today.

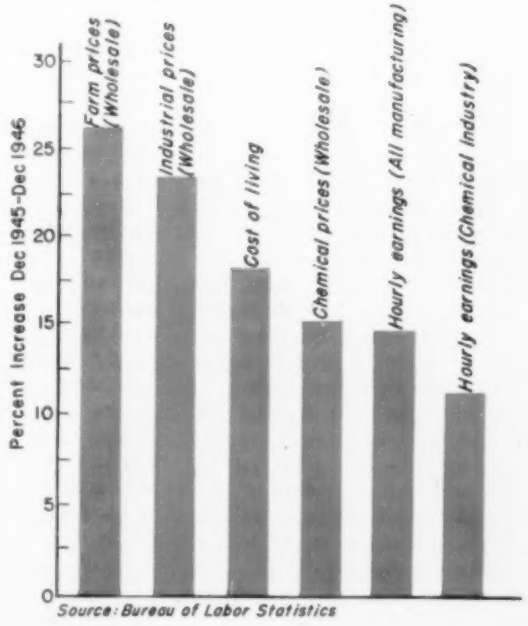
While the statistical cards now at hand seem to spell out a let-down of this limited order, one cannot rule out the possibility of a much stronger bump—say a decline in industrial output of 20 to 30 percent from its current high level, with unemployment rising above five million. A downward move of this magnitude would string itself out over first-half 1948, and must inevitably involve a reduction in durable goods output. As suggested above, however labor holds one key to the gate that leads up this road. Events of the next few months should reveal whether that key is to be used.

But nowhere in the business picture is there to be found a sign that points to the beginning of a serious depression in 1947. On the contrary, recent years have seen the opening of great new frontiers in the U. S. economy. The development of these, coupled with the rebuilding of a rundown peacetime establishment, is a task that cannot help but remain a challenge to both business and labor for some time. And perhaps no group is faced with a more promising opportunity to push on into new territory than the chemical and the chemical processing industries.

PLANT EXPANSION



WAGES AND PRICES CLIMB



INTERNATIONAL OUTLOOK

What's Happening In World Markets?

The well-traveled, industry-grounded foreign editor of Business Week was Iowa-born and trained. After graduating from Grinnell in 1924, John Chapman spent 3 years as a teacher-journalist in the Far and Middle East as prelude to 20 years of world-wide service as an interpreter of the industrial and economic significance of foreign news.

When James H. McGraw, Jr., early in 1945, announced his pioneering plans for a world-wide news bureau to concentrate on industrial, economic and technical developments, John Chapman was given the job of organizing and directing its far-flung activities. Today the bureau has full-time correspondents in 10 of the world's industrial capitals, supplemented by 28 part-time employees—all trained to seek out and interpret the business significance of foreign news. It is from this background and these sources that we report the International Outlook.

JOHN F. CHAPMAN
Editorial Director
McGraw-Hill World News

Had 1946 ended as it began, Russia would have wound up dangerously crowding the United States for position as the world's number one power. The end of the year, however, witnessed the United States emerging triumphant in its long diplomatic tug-of-war with the U.S.S.R. Temporarily thrown off balance in the first six months of 1946 by the Soviet's rapid-fire diplomatic and propaganda moves, which cleverly capitalized on our lack of consistent foreign policy, a toughened, smarter America regained its perspective and turned from a vacillating policy to one of firmness. Result: before the year was out, the U. S. had outmaneuvered the Russians and climbed solidly back into the saddle as the top world power.

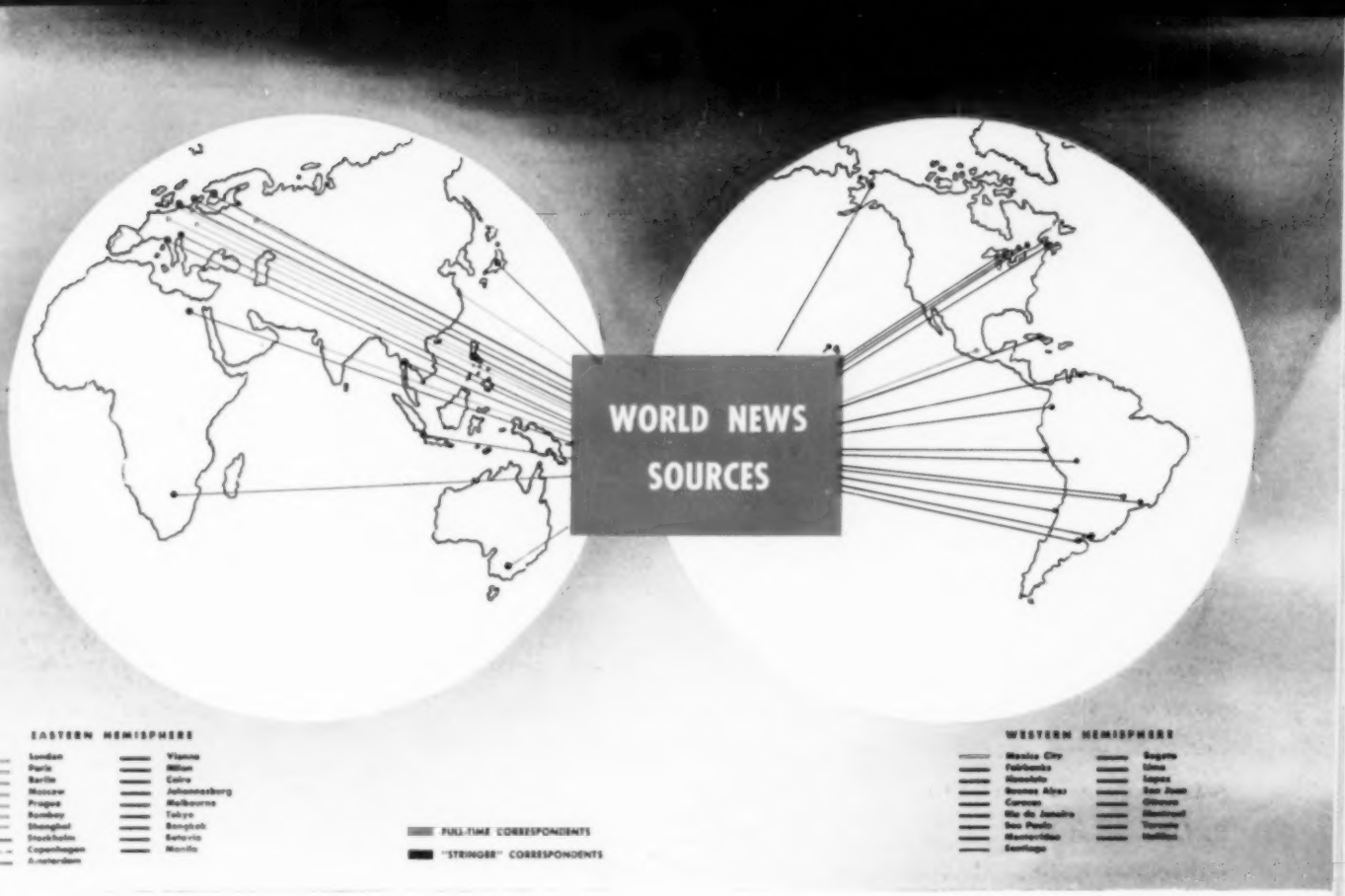
The year 1947 will be a year of decision. The patterns that emerge will affect the world's trade and economy for at least two decades to come. Behind, now, is all the cantankerous dickering that characterized 1946. The United Nations Assembly has weathered the storm, and its initial session wound up in a whirl of agreements on basic policies. All major issues in Eastern Europe have been ironed out by the Council of Foreign Ministers. The last big hurdle is the German peace treaty which will be tackled in Moscow in March. Just how quickly a settlement can be made is anybody's guess. But with the Russians becoming more and more cooperative in almost all international negotiations—a trend that began last November when the U. S. toughened her own role—it's a fair prediction that by June this tough nut will be cracked.

The first six months of 1947, however, are not going to be easy. Rivalry between the U.S.S.R. and the western powers for spheres of influence has only momentarily been fought to a standstill. When the new Secretary of State, General George Marshall, goes to Moscow, sharp words will fly. Charges and counter-charges undoubtedly will be made. Sensational headlines will follow. But this is inevitable—because, to hold its number one spot, and the respect of other nations, the U. S. has to accept the Soviet challenge and move boldly.

The American people in general, and businessmen in particular, however, will not be as upset by these diplomatic crises as they were in 1946. Hardened by a year of international blow-offs, which in each case came to naught, there will be more of an inclination to follow a "business as usual" attitude despite the storms that might roar at the high diplomatic level. All in all, more settlements are likely to turn up in 1947 than anyone dared hope for in 1946.

If the next 11 months shape up and follow the pattern that is now expected, how will the chemical industry be affected?

The answer to that lies with the industry itself. It can be safely said that during the coming year many of the barriers that have hampered world trade in 1946—namely, shortage of shipping space, difficult monetary exchanges, hampering government restrictions, and inoperative trade agree-



ments,—will be lifted and alleviated. It will be up to the leaders of the chemical industry to be alert and ready for the trade opportunities that are certain to develop in the last six months of the year if the international situation follows its expected course.

To date, the postwar international trade record of the chemical industry leaves considerable to be desired. While American industry in general has succeeded in tripling its exports over the 1936-38 average, the chemical industry has yet to reach its prewar level.

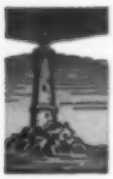
The marked scarcity of basic chemicals has been the biggest bugaboo contributing to the failure to fill the export demand. But even considering this, the chemical industry would seem to have failed to keep pace. For example, the automobile industry, despite its material shortages, labor trouble, and pent-up domestic demand, succeeded in boosting its monthly average exports from $6,300,000 in 1936-38 to $18,900,000 on the last reportable month.

As it now stands, experts in the chemical trade field estimate it will take all of 1947 to get caught up, and perhaps 18 to 24 months to reach the necessary production peak. The industry—in view of the market trend and the potential opportunities in all parts of the world—seemingly would be wise to make token deliveries in greater volume than it has made in the past postwar months.

This business of being the number one power in the world carries with it a challenge. True, the U. S. is top dog, and the chemical industry will always inevitably get a share of world trade. The point is, however, the industry will not get all it can unless it takes a long-range view, and takes advantage of the potential. Token shipments now would be one advisable step. Another would be more exporting of technical know-how,—the selling of American "brains" in aiding the chemical industries of other countries. Admittedly, it would seem that the latter was a little like fostering competition, but the fact remains that countries which are just beginning to industrialize, like India and some of the South American nations, and others which are rebuilding their war-shattered industries, are going to get their materials, equipment, and technical assistance from somewhere else if they can't get it from the U. S. The American chemical industry would seem to have little choice but to keep ahead of the parade,—that is if this comparatively young industry wants to write as fine a record in the foreign field as it has domestically.

The years 1947-48 will bring golden opportunities for the industry. Reasons for this will be clearer as you read the country-by-country reports that follow this general introduction. Through all these dispatches, sent in by McGraw-Hill men in all parts of the globe, there runs the same story—that the demand is terrific, but that upset internal conditions, material shortages, lack of coal and dollars, and a variety of other causes have prevented foreign industries in staging a rapid comeback.

After the first six months, the world trade pattern will become clearer. The new Congress will have been in the saddle long enough to have indicated its planned program toward world trade. By midyear, the die will have been cast on the reciprocal trade program, and the chemical industry will know how it stands. Britain and other western powers have agreed to U. S. proposals for the creation of an international commercial policy pattern. Eighteen nations are scheduled to meet in Geneva, Switzerland, in April to see if they can agree on the details of a charter for the International Trade Organization. Although the mechanics of setting it up will prevent the ITO from being in operation before mid-1948, assuming an agreement is reached and ratification follows, at least the April meeting will be another signpost as to the direction world trade will be taking. The foregoing, plus the writing of the German and Austrian treaties in Moscow next month, will all tend to clarify the international business pattern for 1947.



THE INTERNATIONAL OUTLOOK

RUSSIA

ROBERT MAGIDOFF
Moscow Bureau, McGraw-Hill World News

THE RUSSIAN chemical industry is now back on its feet. Production, according to Soviet government officials, is currently in excess of the prewar level. The comeback is remarkable in view of the fact that the chemical industry sustained more war damage than perhaps any other heavy industry in the U.S.S.R. The new Five Year Plan, now in operation, calls for still greater expansion in 1947 and the subsequent years.

A fully detailed picture of the Russian chemical industry can not be given —since, at no time, does the Soviet government release full production figures in the manner in which they are made available in the U. S. However, enough material has been released, from time to time during the past year to draw a pretty comprehensive picture of the status of the industry today, and to evaluate its potential for 1947.

An American, trying to realize the strides made in rebuilding the battered chemical industry in this country, must fully realize the extent of the damage that was done. The bulk of chemical plants in the early war years was located in the Ukraine, the Donets Basin, and the central areas—all within range of German bombers. At one time during the war, Russian production of nitrogen was down 50 percent, sulphuric acid 77 percent, soda ash 83 percent, dyestuffs 88 percent, and phosphoric fertilizers 65 percent.

The remarkable recovery in the last year, and in 1945, was attributable to the fact that many of the plants had been evacuated during the war further east, where new plants were being built and old plants enlarged. Figures for 1946 have not been released as yet. But the 1945 figures show that an average increase of 15 percent over 1944 was achieved in the output of chemical products for civilian needs.

Pet of Soviets

The chemical industry always has been one of the pet branches of Soviet industry, and 76 various chemical plants were built up and put in operation in the U.S.S.R. during the period 1928 and 1940, including the largest Soviet chemical works in Berezniki (in the Urals).

Most notable is the increase achieved in the production of fertilizers. The output of superphosphates, for example, has increased 66 times between 1913 and 1940.

Four new superphosphate plants are to be built under the new Five Year Plan in Central Asia to exploit the Kara Tau phosphorites, in addition to a special superphosphate department of the Aktyubinsk chemical plant in Kazakhstan. These plants will thus supply all Central Asia with mineral fertilizers of its own.

Before the end of 1947, the superphosphate plants in Odessa and Konstantinovka (in the Ukraine) will have been restored to their prewar capacities and the Vinnitsa and Neva (Leningrad) superphosphate plants are to be put partially in operation. A new plant is to be built in the Ukraine and a department for the production of superphosphates is being set up at the Alaverd chemical works in Armenia (South Caucasus).

Before the end of 1950, the total annual output of superphosphates is to be doubled, compared with 1940, and a total of 2,720,000 tons of new annual capacities are to be put into operation before then.

The major potash deposit at Stebniki in the foothills of the Carpathians, which before the war furnished over 100,000 tons of potash fertilizers, is now being worked to 70 percent of its prewar capacity. It is now proposed to expand the capacity of this plant several times and to build a new soda factory there. It is expected that Stebniki, whose deposits of workable mineral are estimated at some 19,000,000 tons, will be in a position not only to supply all the potash fertilizers the Ukraine needs, but also to ship them to other areas as well.

In addition to the reconstruction of the Solikamsk, Stebniki and Kaluga potassium "combines," the fourth Five Year Plan provides for the construction of the first section of a new potassium "combine" in the Urals. Before the end of 1950, the total output of potassium fertilizers is to be increased by 30 percent, as compared with 1940.

The fourth Five Year Plan provides for an increase in the production of nitrogenous fertilizers by 80 percent as compared with 1940. For this purpose, it is proposed to restore the nitrogen plants in the Donets Basin and the central areas to their prewar capacities, to double the capacity of the Chirchik chemical plant and to start the con-

Sovfoto

Restored soda works in Slavyansk, Stalino Region. It was seriously damaged by the German invaders

struction of a number of new major nitrogenous fertilizer plants, including one in Western Siberia.

The total output of mineral fertilizers (superphosphates, nitrogenous and potassium) is to reach 5,100,000 tons in 1940, according to Soviet government estimates.

The attention devoted to the production of mineral fertilizers under the fourth Five Year Plan is evidenced by the fact that fully 50 percent of the capital investment in the Soviet chemical industry will be used during that period for the restoration of old plants and the construction of new ones for the production of nitrogenous, phosphoric and potassium fertilizers.

The next most important task undertaken by the Soviet chemical industry during the five years will be a considerable expansion of the aniline dye industry.

Unlike the case of the mineral-fertilizer industry, the output of dyes has not even quadrupled between 1913 and 1940.

The new Five Year Plan provides for the complete restoration of the aniline dye industry, as well as for the construction of two new plants for the production of synthetic dyes and semi-products for them. It is also proposed to organize production of dyes and semi-products at the plants set up in the East during the war.

By the end of 1950, the output of synthetic dyestuffs will increase by 30 percent, compared with the prewar mark, and in 1950 a total of 43,000 tons of these dyestuffs are to be manufactured.

In the first place, it is proposed to organize and considerably extend the production of indanthrenes and cryolite dyes. The output of indanthrenes is to be increased 2.4 times and that of cryolite dyes 5 times. The number of brands of dyestuffs produced is to be increased 2.9 times.

Plastics Doubled

Production of plastic materials has been doubled during the war, and a further expansion of this industry is contemplated for the next five years. In addition to the restoration and extension of the old plants, it is planned to build four new plants. Production is to be organized and considerably extended of new types of polymerised and stratified plastic materials, as well as those based on cellulose ethers and carbamide resins. A new Institute for the Polymerization of Plastic Materials has been set up in Leningrad to develop the process of production of vinyl plastic materials.

The new Five Year Plan provides for the increase of soda ash production by 50 percent and of caustic soda by 110 percent, as compared to 1940. The total output of soda ash in 1950 is to be brought to 800,000 tons and that of caustic soda to 590,000 tons, for which purpose a total of 813,000 tons of new capacities are to be put in operation in soda ash industry, and 278,000 tons in the caustic industry.

The extent of capital construction work in the chemical industry during the period between 1946 and 1950 is evidenced by the fact that total capital investments in this industry during the five years will equal the investments made in this industry during the period between 1928 and 1940.

The construction of new plants and reconstruction of old plants are to be based on the maximum introduction of continuous processes, high pressures, oxygen blast, new catalyzers, automatic control of chemical processes and mechanization of various labor-absorbing processes. It is proposed to introduce automatic control of temperature, pressure, automatic safety methods, and communication.

The question of the mechanization of production and especially of labor-saving methods in the chemical industry in the coming years takes on special importance, since more than 50 percent of the workers of the establishments of the Ministry for Chemical Industry of the U.S.S.R. are women, and the number of young workers (not more than 25 years old) exceeds 40 percent of all workers.

The Ministry of the Chemical Industry of the U.S.S.R. is currently running a total of 17 scientific research and designing institutes, 5 higher chemical schools, and 17 technical schools. M. G. Pervukhin, Minister for the Chemical Industry recently said that it will be necessary to install modern laboratory equipment and considerably extend Soviet chemical scientific research. Equipment will undoubtedly be bought in the U.S.A.

MEXICO

ERNEST HEDIGER
Mexico City Bureau, McGraw-Hill World News

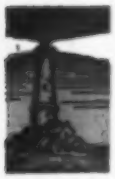
IN SPITE of the still continuing difficulties of receiving sufficient raw materials and equipment from abroad—nearly exclusively from the United States—1946 was an excellent year for the young and still growing Mexican chemical industry.

Although exact production figures for 1946 are not yet available, not even in the form of estimates, output for the year under consideration is known to be considerably higher than during any of the previous years. (For 1945 and previous statistics, see page 120-131 June 1946 issue of *Chemical Engineering*).

Development of the plants already in existence or under construction during the year was slower than expected. The Sosa de Texcoco plant, for instance, which was to produce large quantities of soda ash and caustic soda toward the end of 1946 from the deposits of the dried-out Texcoco lake in the outskirts of Mexico City, could not be completed during the year as planned. Only part of the machinery has arrived in Mexico so far, and large scale production of these commodities will probably only start about August 1947.

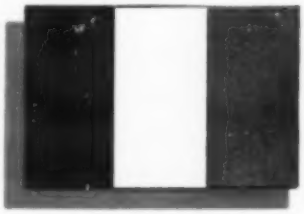
Outlook for 1947 is good, though no very large scale development is to be expected during the coming year. Money is easily available, but Mexico is too poor yet in electrical power to allow for the building of large chemical plants, and equipment from abroad is still slow to come or hard to get at any price.

Greatest development planned for 1947 is the building in the vicinity of Mexico City of a $10,000,000 plant for the manufacture of nitrogenous fertilizers from natural gas. The gas is to be piped from the Poza Rica fields, on the Gulf, by *Petroleos Mexicanos* (PEMEX), the government oil trust. Blueprints for the new plant, which will be set up by an autonomous, semi-governmental corporation, are at present being drawn by the Chemical Construction Corp. of New York. The Mexican Government will borrow the necessary funds at low interest rate from the International Development and Reconstruction Fund in Washington, D. C.



THE INTERNATIONAL OUTLOOK

FRANCE



MICHAEL MARSH
Paris Bureau, McGraw-Hill World News

Most of the French chemical industries, with the important exception of petroleum refining, leather, soap, and paper, reached a level in 1946 not much below 1938 output. This represents a tremendous upswing from the almost complete stagnation at the time of the liberation in September 1944, when the index of chemical production stood at 5 percent of 1938. The recovery has been aided by the fact that most chemical plants, except petroleum refineries and rubber processing plants, were not tremendously damaged by the war.

In 1947 the industry hopes generally to make a considerable further boost in output. The great bulk of this production will be needed for domestic industry and reconstruction, but it is hoped to export $130 million worth of chemical products during the year, a considerable boost from 1938. Half of these exports would be organic chemicals.

Best picture of the chemical industries' 1946 performance and hopes for 1947 is in figures prepared by the French Plan Commissariat, representing joint estimates by industry, labor, and government services. Table I gives these estimates for a number of basic chemical products.

Among industries not mentioned in the table, the soap industry has lagged badly, owing chiefly to shortage of fats. By the fall of 1946 toilet soap output was back only to 55 percent of prewar, household soap to 17 percent of prewar, and industrial soap to 33 percent of prewar. Output of detergents, which are widely used as soap substitutes, had boomed on the other hand to 38 percent above the prewar level.

According to M. Hirsch, Technical Director of the Plan Commissariat and formerly an official of Establissements Kuhlmann, it is hoped in 1947, in addition to attaining the increased output noted in Table I, to push especially the output of plastics and dyestuffs. Dyestuffs will occupy a major place in the French chemical industries' export program for 1947, as shown in Table II. Other major items of French export will be pharmaceuticals, essential oils, glass, tires, and perfumes.

However, France will still in 1947 import a considerably greater value of chemicals and chemical materials than she exports. A brief breakdown of planned imports is provided in Table III.

On the important question of what place French firms can take in markets formerly supplied by Germany, the French industry is reported generally undecided. One of the main reasons for lack of definite plans is uncertainty as to the future of the German industry. Actually, in the French zone of Germany, occupation authorities have so far been struggling chiefly to get back into production the great Ludwigshafen-Oppau complex and the other I. G. Farben plants in the zone.

I. G. Benefits France

The I. G. Farben factories, which were confiscated by the French military government and are operated under a French administrator, furnished France with a fifth of all her chemical imports (in the narrow sense of the term) during the first eight months of the year ($5,500,000 out of a total imports of $27,600,000), and by the end of the year they were scheduled to ship to France at the rate of $1,200,000 a month.

On a composite view, therefore, the French chemical trades—instead of supplanting Germany in European or overseas markets—still import more than they export, and France is still in the position of relying on German supplies to satisfy part of the home market.

This does not mean of course that no French products will come into former German markets. The French chemical export goals for 1947 are about 30 percent higher than actual exports in 1938, and some 35 percent over the estimated 1946 figures. These are value figures, but adjusted for changes in price since 1938, and they therefore represent a considerable expected real expansion. French chemical imports, if they reach in 1947 the hoped-for total, will also be about 30 percent above 1938 and about 20 percent above 1946.

In the field of new investment, current construction in the French chemical industries is being held down by lack of steel, just as current production is often hampered by the coal shortage. One of the most significant efforts on foot is the plan—drawn up by officials from the major petroleum companies working with government technicians—to refine at home the great bulk of France's petroleum products consumption, in order to save foreign exchange.

Table I—French Chemical Output

(Thousands of Metric Tons)

Product	1938	1946	Plan for 1947
Sulphuric acid	1,200	1,000	1,200
Superphosphates	1,350	1,100	1,350
Sod. carbonate	480	480	600
Nitr. fertilizer (N_2)	200	150	200
Potash fertilizer (K_2O)	580	580	660
Hydraulic lime	1,500	1,500	1.3 to 1.5*
Plaster	700	1,000	1.3 to 1.5*
Bricks and tiles	4,700	4,000	5.5 to 6.6*
Petrol. prods. (incl. synth.)	6,000	2,800	4.9
Rayon filament	34	31	43
Rayon, staple fib.	...	18	25
Hides and skins	80	56	60
Paper and p.-bd.	1,280	660	770
Glass	505	606	650 to 680
Rubber (incl. synth.)	65	62	72 to 78

* Millions of metric tons.

Table II—French Chemical Export Plans for 1947

(Millions of Dollars)

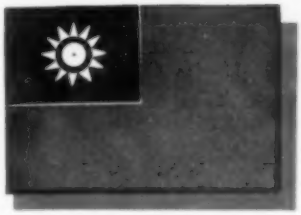
Organic chemicals		57
Dyestuffs	15	
Pharmaceuticals	17	
Essential oils, etc.	17	
Mineral chemicals		8
Glass		18.5
Rubber		20
Tires	13	
Perfumes		13
Rayon filament		5
Hides and skins		3
Other		5.5
Total		130

Table III—French Chemical Import Plans for 1947

(Millions of Dollars)

Paper and pulp		50
Hides and skins		29
Chemical raw materials		197
Rubber and rubber arts., inc. synth	18.5	
Carbon black	8	
Tars	13	
Nitr. fertilisers	13	
Total		278

Source: Commissariat du Plan.



CHINA

A. W. JESSUP
Shanghai Bureau, McGraw-Hill World News

UNITED STATES domination of the market, wild price fluctuations, and small Chinese production, highlighted the chemical business in China in 1946. In volume, imports of industrial chemicals and chemical products are well below those of prewar years. However, value of imports during the first ten months of 1946 was $49.3 million compared with a 1936-37 annual average of 28.2 million. As never before the United States dominates the import list, accounting for roughly 75 percent of all chemical imports. In 1936-37 the U. S. was the source of only 11 percent of China's imports of the same products.

Prewar leaders in the Chinese markets were Germany, Japan and Great Britain, with Germany accounting for 40 percent. Both Germany and Japan are out of the picture, with little likelihood of coming into a competitive position for several years. Whatever competition there is will come from Great Britain, which until recent months has shipped very small quatities to China.

U. S. Dominant

At least through 1947, the U. S. will continue in the same dominant position. This position could be retained indefinitely providing good marketing and service assistance is given to the Chinese purchasers. Complaints have been lodged by purchasers over poor packing, lack of or sloppily prepared invoices and shipping documents, cancellation of accepted orders and general disinterestedness of U. S. suppliers. Granted that some of this may be avoidable, the buyers tend to ignore even legitimate excuses if offers coupled with better service are available elsewhere.

Speculation and short supplies have turned prices upward to the sky. At the same time, certain chemicals in over-supply are down in price and are being sold at c.i.f. valuation or below. Some examples of the price situation (because of the currency value fluctuation, figures are in Chinese dollars) are:

Sulphuric acid is selling at CN$800,000 to CN$1,000,000 per 100 lb. whereas the landed cost is only CN$90,000. Local manufacturing cost per 200 lb. is CN$700,000.

Bleaching powder costs CN$100,000 per. bbl. landed, but sells for CN$360,000 per 133 lb.

Sulphur black is very short and costs CN$5 million per 133 lb. Landed cost of a similar quantity is less than CN$350,000.

Nitric acid has jumped from CN$120,000 to CN$800,000 per 144 lb. in two months.

Sulphuric acid in three weeks tripled in price from CN$50,000 to CN$150,000 per 200 lb.

Glycerine dropped from CN$340,000 to CN$180,000 per ton of 110 lb.

Magnesium carbonate and sodium silicate are selling below landed costs, as is calcium carbide which is sold at the c.i.f. value.

Until there is some stabilization of the currency, prices will not settle down to any fixed level or even a predictable curve. Largest effect on prices will come when strike-stranded shipments begin arriving in January.

Domestic production is exceedingly low and dropping daily as high costs force curtailment of manufacturing. Many private firms have stayed in operation not because manufacturing was profitable, but because the losses were less than payments which the Bureau of Social Affairs would force the employer to pay laid-off workers. Countless firms in this fix have been existing on borrowed cash, for which they pay interest of 15 to 20 percent per month.

What China will need next year are dyes and colors, bleaching powder, sulphuric and carbolic acids, chemical fertilizers, sulphur black and caustic soda. What China will be allowed to buy under the tight import licensing control is still unsettled. The Import Quota Allocation Department, headed by Li Kan, is endeavoring to adjust essential needs for 1947 to the limited available foreign exchange. It is safe to say that products essential to the textile industry and chemical fertilizers will receive preferential treatment.

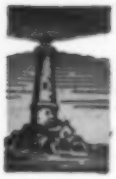
Chief goals of China's five year industrialization plan are:

Product	Capacity, Metric Tons
Sulphuric acid	450,000
Ammonia sulphate	100,000
Superphosphate	210,000
Caustic soda	125,000
Soda ash	250,000
Bleaching powder	40,000
Indigo dyes	5,000
Calcium carbide	45,000

Chinese Chemical Imports, Tons

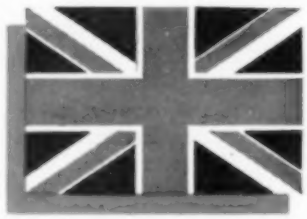
Article	1936-37 Average All Sources	1936-37 Average United States	1946 (January–October) All Sources	1946 (January–October) United States
Acetic acid	893		985	939
Hydrochloric acid	3,257		379	140
Nitric acid	247		81	64
Sulphuric acid	1,013		3,558	3,492
Acids*	2,027	730	2,390	2,260
Sulphate of ammonia	158,089	1,013	2,498	121
Bleaching powder	7,636		9,771	7,021
Carbide of calcium	3,618		1,375	1,163
Explosives (industrial)	($246,735)		139	3
Glycerine	($116,600)	($1,670)	449	10
Fertilizers*	9,972	250	30	18
Phosphorus	291		201	151
Chlorate of potash	4,545		2,222	1,620
Saltpeter	652		14	
Sulphur	6,152	2,727	2,233	2,094
Soda ash	28,696	93	11,863	4,114
Nitrate of soda	2,054	604	198	98
Caustic soda	22,458	5,766	10,991	4,057
Silicate of soda	631	239	3,759	3,104
Sulphide of soda	2,774		3,085	2,524
Soda, bicarbonate (soda crystal)	2,124	57	10,121	9,068
Other chemicals	($4,533,415)	($504,950)	26,599	19,252
Medicines, drugs*	($3,178,770)	($395,980)	6,297	5,439
Aniline, other coal tar dyes	($4,188,400)	($475,437)	1,591	1,259
Oxide of cobalt	($103,200)		46	22
Dyes*	($76,500)		268	18
Indigo				
Liquid, paste 20% or under	4,099	1,558	2,058	2,005
Liquid, paste 50%	2,341	635	469	358
Grain or dry 60%	670	115	272	116
Printing ink	1,406	593	1,581	1,445
Sulphur black	5,921	570	1,917	1,754
Zinc white	1,868		2,443	1,599
Tans, tanning material			6,313	4,116
Varnishes			191	142
Paint*			1,559	1,287
Pigments*			2,325	1,545

*Not otherwise recorded. $ valuations are in U. S. currency, used only where weight statistics were not available.



THE INTERNATIONAL OUTLOOK

GREAT BRITAIN



FREDERICK R. BREWSTER
London Bureau, McGraw-Hill World News

ALTHOUGH Britain's Labor Government has nationalized some of the country's key industries, and has taken steps to nationalize others, there is no indication whatever at the present of any intention to nationalize the chemical industry or to amalgamate its export selling efforts under government control. The 1947 policy of the British government is one of assisting or directing the chemical industry to supply first those other British manufacturers who are engaged in producing for export, and then, when these demands have been satisfied, to allow the remaining surplus chemicals to be exported through private trading.

The demand for chemicals of all kinds from the British home market, however, appears to be insatiable—which is not surprising in view of the vacuum that has been built up by unfilled requirements that have been accumulating since 1939. With the coal supply promising to be worse this winter than last, the outlook for 1947 is for production to fall steadily farther behind the home demand, even though the industry's output has now risen well above the prewar figures. To American chemical exporters, this is significant—since it means that the British in 1947 will be lucky to hold their own as exporters of chemicals.

Export Problems

Solutions must be found to these problems before Britain can hope to regain its hold on exports:—

1. *Rising Costs of Production*—British chemical-producing plants have been inadequately maintained all during the past seven years. It is not now possible to shut down any parts of these plants to accomplish the necessary renovation and modernization, because of the tremendous pressure for continued operation exerted by present demand for chemicals. Even if shutdowns could be arranged, the industry would be unable to make the needed improvements because of a shortage of plant-process equipment, repair parts, stainless steel, etc., as well as of building materials, and because what supplies of steel and brick there are in Britain are being directed by priorities into housing. This situation means not only steadily rising costs of production but also a gradual yet steady decline in production volume.

2. *Shortage of Coal*—All British industries are short of coal for fuel and a general 5 percent reduction in coal consumption was ordered for most industries, including chemical manufacturing, as of Jan. 1, 1947. (The coal shortage does not create any critical situation as regards the use of coal as a raw material in chemical processing). ICI engineers have estimated that this coal cut will cause a reduction in chemical output of about 4 percent for the industry as a whole. (As a result of the coal shortage, ICI has already lost $10,000,000 worth of export business).

3. *Restricted Plant Capacity*—The chemical industry is unable, because of the same factors which limit plant modernization) to make expansions of its plant that would be justified to cope with the increased demand.

4. *A shortage of steel drums*—Shipping containers will definitely become a critical factor further limiting the volume of chemical exports shipped in 1947. And since steel sheet for all industries is seriously short in supply, no soluton here is likely to be found.

5. *Shortage of Skilled Help*—Because the armed services in Britain are being maintained at a greater strength than prewar, the chemical industry finds it difficult to increase its force of young scientific workers.

The amount of chemical equipment removed from Germany to Britain now promises to be less than the quantity which had been expected a year or six months ago; the quality of such equipment is also getting poorer; in all, this field of endeavor does not hold out much hope of alleviating the equipment shortage.

Markets being regained: Despite the increase in chemical manufacturing within Canada that has been the result of the war's stimulus, and despite also the increased flow of American chemicals into Canada the United Kingdom confidently expects to rebuild its sales to Canada to a volume at least equal to the 21 percent share of Canada's chemical imports it supplied prewar. In fact U.K. exports to Canada already have exceeded in value those of 1938.

ICI are readying for release early in 1947 "something very big" in the application of "Perspex" (acrylic plastic used in airplane glazing, etc.) They are concentrating on two fields—dyestuffs and pharmaceuticals—in their activities to capture the world markets vacated by I. G. Farben. By the beginning of the war, British dyestuffs were more than holding their own with foreign competition (i.e. German mainly) in the world market, and in some substances the British had established a comfortable lead by reason of their extensive research activities (ICI's Caledon Jade Green, Monastral Blue, and Dispersol and Duranol colors for acetate rayon, are examples). To continue this trend, ICI is extending its dyestuff activities at home, and is branching out abroad with such projects as the joint company formed with Tata to manufacture dyestuffs in India. The second ICI objective, pharmaceuticals, reflects what has been the most significant recent development in British chemical manufacture: namely, the rapid rise of synthetic medicinals, which had previously been left almost entirely in German hands.

ICI Operates 23 Plants

ICI is still operating for the government—23 factories originally set up during the war to meet wartime needs. These plants are producing light metals, heavy chemicals, explosives, penicillin, alkalis, and other products. ICI is negotiating to take over and operate privately "quite a few of these," to add to the several it has already taken over into its own operations which include a large plastics plant (molding fibers) at Hillhouse, Lancashire, and huge light alloy plant at Gowerton, South Wales, whose production is now devoted almost exclusively to aluminum for prefabricated housing. This Gowerton plant, actually a larger scale copy of the company's own light alloy factory at Holford, near Birmingham (which went into production in December 1940) brings ICI to a position where it supplies one-fifth of the total U. K. output of light alloys.

INDIA

J. K. VAN DENBURG, JR.
New Delhi Bureau, McGraw-Hill World News

THE GROWING Indian chemical industry, proud of its record during the war when it demonstrated that it could turn out a high quality of both heavy and fine products, appears to be marking time just now—waiting for the country's independence and the clearing of the many stumbling blocks that have retarded its full development.

This marking time is true only in the production field, however. Research is proceeding apace and once the road is clear the industry should take a prominent place in the growth of a strongly nationalist industrial boom.

Perhaps in no other Indian industrial field are there such bitter feelings about the record of the British government of India. The leaders see in the barriers to import of plant equipment, the prohibitive freight rates, the welcoming of imported products and the refusal to enact protective tariffs, the deft touch of British mercantile policy.

Looks to America

They feel that all the progress they have made so far has been due to their own efforts. They have great plans for the future when, they feel, an independent Indian government will recognize the importance of a strong chemical industry in any program of national development.

Pending such recognition India represents a superb market for America; first insofar as she can meet India's current needs, second in assisting the development of India's future industry by the export of equipment and technical knowledge. The anti-British feeling will be a great aid.

That America is taking full advantage of this is shown in the U. S. Bureau of Foreign & Domestic Commerce breakdown of 1945 trade with India. Coal tar products, most in the form of dyestuffs, totalled $6,900,000 and medicines and pharmaceuticals another $5,600,000, reflecting the cutting off of prewar supplies of these materials in Germany. Industrial machinery of all types totalled $7,400,000. Doubtless the 1946 breakdown will show great increases when it is compiled. Impressive as these figures sound, however, they probably represent only a small fraction of English trade in the same categories.

It has been announced, however, that during 1946-47 about 200,000 tons of chemical fertilizers will be available. Of this 180,000 tons will be imported. And Imperial Chemical Industries Ltd. will supply 140,000 at a price of about $72 a ton (compared to the prewar $24).

Prewar India's chemical industry was barely perceptible. A few acid plants, a small caustic soda and chlorine plant and a closed-down soda ash plant were the only major factories. Today the picture has changed greatly. Here is a review of a few important fields:

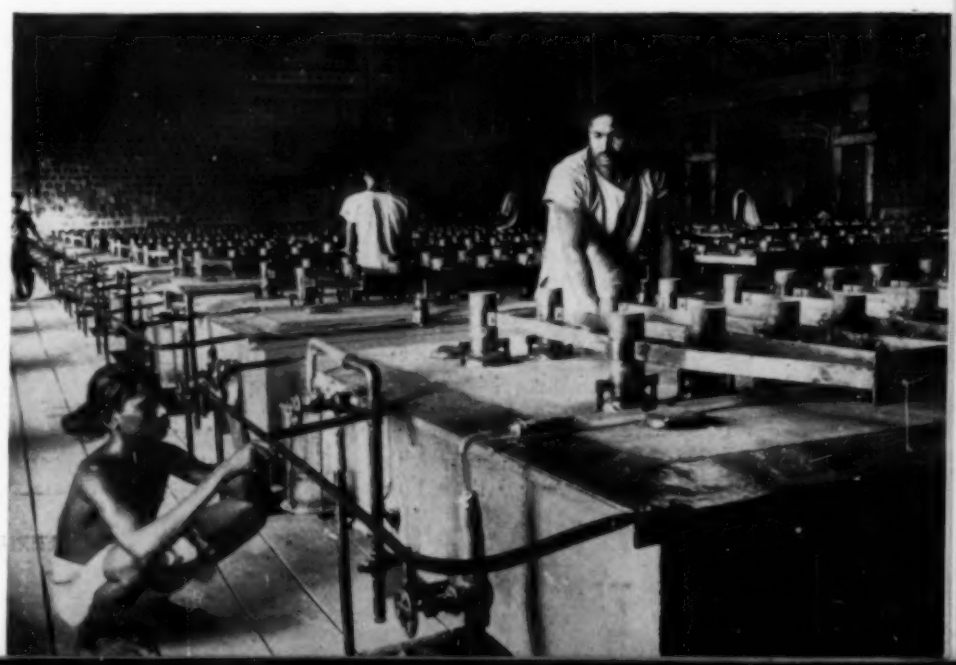
Sulphuric Acid—Prewar about 20 small chamber process plants were turning out a total of some 30,000 tons annually. They had a combined capacity of 85,000 tons but there was no market for their full production. Imports in the last prewar year were only 131 tons. Now, as a result of wartime demands, there are several more plants and the combined capacity is about 100,000 tons. Consumption has fallen off from the wartime 56,000 tons, but emergence of new fertilizer plants, and proposed synthetic fiber factories is expected to take up some of the slack. One snag to great expansion of the industry in the future is the lack of adequate domestic deposits of high-grade sulphur. But gypsum is slated for interim duty until a cheap foreign source (Sicily before the war) or a method for utilizing pyrites is developed.

Caustic Soda—A virtual ICI monopoly before the war, imports totalled 25,000 tons in 1938-39, virtually the entire domestic consumption. At present productive capacity is about 12,000 tons, half by the electrolytic process and half from causticized soda, but actual output is estimated at about a third of this. Against this is an estimated demand for about 55,000 tons which ought to skyrocket to more than 120,000 tons as new rayon, soap, hydrogenated oil and paper industries develop.

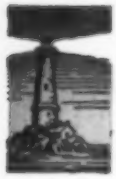
Soda Ash—Another ICI field, in which imports were 65,000 tons in 1938-39 and 81,049 in 1939-40. Now there are three soda ash plants in operation in India with a combined capacity of about 50,000 tons compared to demands for around 60,000 tons and a further immediate need for another 40,000.

Chlorine—Hinging on the caustic soda industry, domestic production probably is around 5,000 tons compared with prewar imports of 10,000 tons. With development of new industries such as paper, chlorine solvents and chlorine-compound insecticides such as DDT, demand is expected to be around 45,000 tons.

Further demonstration of the intensive imports of chemicals and chemical products into India from Great Britain came, interestingly enough, the very day the McGraw-Hill World News report on the industry was completed. On that day a British freighter docked at Bombay, India's premier port, and her report to Customs officials showed many chemicals.



Alkali-chlorine electrolytic cells. They are of Siemens-Vohler type, 27 in number with an energy consumption of 15,000 Kw.



THE INTERNATIONAL OUTLOOK

GERMANY

JOHN C. CHRISTIE
Berlin Bureau, McGraw-Hill World News

THE GERMAN chemical industries generally have operated on a hand-to-mouth basis during 1946. Like the rest of German industry, they have suffered chiefly from lack of coal. It is estimated that during the past year the chemical industries as a group reached about 40 percent of 1936 production but had slumped to about 20 percent as the year drew to a close due to the winter fuel shortage. It appears that they will be handicapped by lack of fuel until toward the end of the first quarter of 1947. Mid-year should see the beginning of a fairly substantial improvement, particularly in the combined U. S. and British zones, as a result of more coal on one hand and the initial effects of new pump-priming measures on the other. The merger agreement provides for importing critical raw materials to stimulate production and also for a freer exchange of indigenous resources within the two zones.

Plant Dismantling

Dismantling of chemical plants in the western zones has been confined to those in the munitions category. Other plants have been listed for reparations in accordance with the 1949 level of industry plan but reduction of capacity in pursuance of this level has not been started pending final agreement to treat Germany as a single economic unit. Some chemical plants have been dismantled in the Soviet zone but the extent is not known.

Under the initial RFC self-liquidating import program, $3,500,000 out of $7,750,000 in inventory advances is allocated for chemical industries in the U. S. zone. Plans call for importing coal for production of soda ash, crude drugs for pharmaceuticals and toluene, benzene, and phthalic anhydride for dyestuffs. Orders had not yet been placed by New Year's Day and consequently the effects of this stimulus will not be apparent before mid-year. The export possibilities for all three commodities are far beyond what is required to liquidate the RFC advances. It is hoped that sufficient coal and coal tar products will be available from the Ruhr later in the year to sustain these industries at higher levels.

Chemical industries in the combined U. S.-British zones will benefit by the provision in the zone merger agreement for a special class of imports, which are to be paid for out of the pooled proceeds of exports and which are to be used for industrial rehabilitation without regard for immediate export prospects. This program plus possible furtherance of the self-liquidating import device should result in marked improvement in the chemical industries toward the latter part of the year providing fuel requirements can be met.

The prospects of soda ash being available for export again are of particular interest in view of the critical world shortage. Several European countries already have made known their willingness to pay exceptionally high prices and U. S. buyers can expect stiff competition in bidding for the limited quantities which will be made available from the combined zones. Small quantities should be available within the first half of the year and a fairly steady increase is expected thereafter.

It is estimated that Germany's potash mines are now producing at about 70 percent of capacity due to shortage of fuel, manpower and maintenance materials. The Soviet zone is the only area having a surplus over and above fertilizer requirements. Germany exported about 40 percent of its potash production in prewar years. Although production is only 70 percent, exports have been running somewhat over the 10 percent margin because of the shortage of other fertilizer components—nitrogen and phosphates.

The Potsdam Agreement provides that the production of synthetic nitrogen shall be prohibited but it is permitted to continue temporarily until Germany is in a position to meet her requirements out of imports. During the past year, German synthetic nitrogen production has met only about 45 percent of the requirements for fertilizer. Another 12 percent of the fertilizer requirement has been imported and some nitrogen in the form of calcium cyanamide has been used. It is hoped that in 1947 Germany will be able to meet at least 70 percent of her nitrogen requirement for fertilizer out of domestic production and imports.

The serious shortage of coal tar products from the Ruhr has hit plastics and dyestuff production very hard. Dyestuff production has been running at only about 10 percent of the permitted rate under the 1949 level of industry. The British have been producing some synthetic phenol for plastics and resins but output has been such that the U. S. zone has had difficulty in getting even 60 tons per month for food-can lacquers.

Among the imports badly needed for German chemical industries are: iron pyrites, sulphur, natural rubber, high alpha cellulose pulp (for high tenacity rayon cord), arsenic (for insecticides), phosphate rock (both for metallurgical use and for manufacture of superphosphates), and fats and oils.

The Russians and British have been importing iron pyrites from Norway and may have the Norwegian production sewed up. If so, the U. S. zone will have to find another source of supply.

The U. S. and British zones have about 80 percent of Germany's rubber tire production capacity, which is about equally divided between the two areas. In the past year, output has averaged only about 40 percent of prewar rate.

Plants in Good Condition

German chemical plants are generally rated as being in good condition. However, there is a shortage of repair items and the lack of paints, oils and other forms of protective coating is beginning to show ill effects on equipment.

Now that the procedure for research control has been established, increased activity can be expected in the coming year.

U. S. military government has given the Germans permission to carry out a program of salvaging useful chemical and metallurgical components of both toxic and non-toxic munitions, including explosives, gases, etc. Originally the material was slated for disposal at sea. An experimental recovery plant is being established in Bavaria.

AUSTRALIA

HERBERT LEOPOLD
Melbourne Bureau, McGraw-Hill World News

SHORTAGE of fuel and process coal throttled production in all major chemical branches in Australia throughout 1946, and the situation is not likely to improve until collieries can be mechanically expanded to meet greatly increased postwar demands. Labor unrest, which has so far not affected the traditionally peaceful chemical industry direct, is nevertheless one of the important factors governing the 1947 chemical outlook, and the outlook from this particular angle is none too good.

The year may witness the laying of the foundation stones of two new chemical industries in Australia. A government project calls for establishment of a 10,000-ton-a-year aluminum reduction plant in Tasmania and supporting bauxite refining plants on the mainland. And Courtauld's is at the point of materializing its long-standing plan to build Australia's first viscose rayon plant. Establishment of a plant for fine writing papers by another English concern is well under way, partly with American equipment.

These new industries are not as yet supported by sufficient chemical production capacity, and most of the chemicals required to treat bauxite and cellulose will have to be imported. Incidentally, Courtauld's woodpulp supply will also come from abroad, mainly or entirely from Canada.

Australian Chemical Industry Statistics

Year	Number of Factories	Persons Employed	Salaries and Wages Paid	Power, Fuel and Light Used	Value of Other Materials Used	Value of Production*	Value of Output†
1938–39...	238	5,346	3,238,400	$387,200	$10,892,800	$12,246,400	$23,526,400
1943–44...	326	9,662	8,739,200	1,484,800	27,443,200	25,728,000	54,656,000
1944–45...	349	10,477	9,417,600	1,603,200	28,956,800	27,430,400	57,990,400

* The value of production is the value of output minus the cost of raw materials, containers, power, fuel light, lubricants, water, equipment replaced and repairs to plant, and therefore represents the value added in the process of manufacture. † The value of output is the wholesale selling value at the factory of goods made or processed during the year, including by products.

Materials Used and Articles Produced in the Australian Chemical Industry 1944-45

Materials Used	
Limestone	75,107 tons
Salt	337,545 cwt.
Sulphuric acid	170,706 cwt.
Sulphur	17,192 tons
Alkali for soda crystals	8,155 cwt
Soda ash	5,264 tons
Essential oils	339,826 lb.
Glycerine	2,192,687 lb.
Tallow	18,611 cwt.
Stearine	666,850 lb.
Carbolic acid	74,699 Imp. gal.
Urea	14,189 Imp. gal.
Formaldehyde	110,959 Imp. gal.
Wool grease	229,546 lb.
Total value of above	$2,989,920
Total value of other materials used (unrecorded)	$20,208,515
Articles Produced	
Hydrochloric acid	7,560,211 lb.
Sulphuric acid	90,771,520 lb.
Sodium silicate	15,146,200 lb.
Sodium sulphate (salt cake)	17,513,133 lb.
Sodium sulphate (Glauber's salt)	7,373,853 lb.
Sodium thiosulphate	1,394,588 lb.
Soap, toilet	647,900 lb.
soft	337,400 lb
liquid	1,298,600 lb.
Total value of above	$2,845,981
Total value of other articles produced (unrecorded)	$55,145,520

Figures do not include chemicals produced as byproducts by metallurgical, etc., plants, for instance, sulphuric acid.

Australian Imports and Exports of Chemicals, 1938-39 and 1945-46

	1938–39	1945–46
Imports		
Acids	$428,800	$640,000
Pharmaceuticals	2,307,200	4,051,200
Sodium salts	2,297,600	1,238,400
Argol	70,400	268,800
Cyanides of potassium and sodium	982,400	339,200
Dyes	1,459,200	2,019,200
Perfumery and toilet preparations	806,400	425,600
Essential oils (non-spirituous)	486,400	976,000
Exports		
Medicines	$611,200	$2,048,000
Perfumery and toilet preparations	137,600	2,822,400
Total incl. all other chemicals and drugs	1,344,000	9,596,800

SPAIN

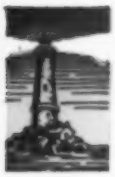
KARL FALK
Fresno State College, Fresno, Calif.

Two World Wars and a policy of greater independence of foreign sources have been chiefly responsible for the development of the Spanish chemical industry in recent years. This development has been severely checked, however, by the extensive physical destruction of chemical plants and general economic disruption resulting from the 1936-9 Civil War, when Spanish chemical output was roughly halved. In the intervening years the degree of recovery and expansion has varied considerably in different branches. During World War II Spain's geographic and economic isolation as well as her political isolation have given added impetus to the trend toward chemical self-sufficiency, which has been reflected in the establishment of many new chemical plants and the expansion of older ones to produce a greater variety of products.

Under the National Syndicate of Chemical Industries (Sindicato Nacional de Industrias Químicas), the Spanish chemical industry is subject to considerable specific regulation, including numerous taxes, high duties, import quotas, import and export permits, strict foreign exchange controls, price controls, government authorizations for building new plants and expanding capacity based on "essentiality," and to all the general restrictions of an authoritarian economy.

In terms of capital investment, the Spanish chemical industry, employing about 10,000 persons, was before the war the seventh largest industry of Spain, and accounted for an annual output of 500 million pesetas (roughly $50 million). Its traditionally close association with the mining industry is due to the fact that Spain's chemical industry is based chiefly on available raw materials, pyrites, sulphur, potash, rock salt, phosphates, and mercury, plus naval stores and botanicals. Predominantly an agricultural economy, Spain requires chiefly fertilizers and agricultural chemicals, pharmaceuticals, dyes, and pigments.

During the war Germany and Switzerland were Spain's chief chemical suppliers, while in peacetime they shared this position with France, Italy, and the United Kingdom, who were also important customers.



Sulphur and Sulphuric Acid Face Promising Futures

LAST YEAR, production of sulphuric acid returned to normal with Ordnance plants closed for the full period and the output of acid coming from industrial plants. Closing of government works had a two-fold effect. In the first place it brought a reversal in the production curve which had been rising each year from 1939 through 1944, levelled off in 1945 and turned downward in 1946. In the second place, the drop in the supply of spent acid made available from government production, placed a greater burden on private plants. Several factors unfavorable to production and consumption of acid arose during the year but in spite of enforced cutbacks, increased activities in the final quarter of the year pulled production to a level estimated to be slightly in excess of that reported for private plants in the preceding year. This means that production of sulphuric acid in 1946 was the highest ever attained in a peacetime year.

The adjustment to changes in consuming markets included the elimination of high explosives and other products used solely in the war effort. The majority of other materials and finished products which require sulphuric acid in their manufacture and which have important military uses, are likewise essential in general industrial lines and the loss in military buying has been more than offset by an increase in civilian orders.

In the last six years requirements for sulphuric acid in industry have increased at a higher annual average rate than was the case in preceding years. This has been a natural consequence of the general rise in industry but there may be some question as to whether the present position of acid-consuming industries may be regarded as representing a new normal or whether they have been swollen by wartime influences and whether 1946 activities are an aftermath of the war with buying stimulated by a backlog of deferred needs and the added objective of building a more satisfactory inventory position.

Reference to the industries which offer the largest outlets for sulphuric acid, gives assurance that most of them will maintain or improve upon their present position in the year that lies ahead. Starting with production of chemicals, it is found that the growth in the last six years, while unusually large, appears to have a solid basis with the customary expansion accelerated by the opening of the market to the flood of new products developed in recent years but previously held back from commercial development. Rayon mills have taken on more acid in practically every year since the industry was established. Last year full capacity operations were not reached yet acid consumption moved up appreciably and a further rise is expected this year which could be as high as 15 percent if raw materials are fully available. In the pigment field, titanium dioxide is gaining a larger tonnage each year but never high enough to fill demands. Sulphate of ammonia was among the products most directly affected by work stoppages last year and the low 1946 output is sure to be topped in the current year. Every consuming field for steel is clamoring for deliveries of the metal. In other metallurgical lines demand is active, indicating a larger use of acid.

Turning to the largest single outlet —the manufacture of superphosphate— the outlook is more difficult to evaluate. There is no doubt that the fertilizer industry has grown to a point that makes it vulnerable. Acreage and outputs have been pointed toward satisfying domestic needs and providing a large part of food supplies for outside countries. In addition there has been the incentive offered by the prevalence of high prices for all agricultural products. While the high prices and the heavy export demand exists, the situation should not change to any extent but as prices decline and export buying tapers off, a gradual readjust-

Data and Estimates on U. S. Sulphur Activity and Sulphuric Acid Production, 1944-1946

Sulphur and pyrites in long tons; Acid in short tons, 100 percent

	1944 Revised	1945 Revised	1946[1]
Sulphur mined	3,218,158	3,753,188	3,890,000
Sulphur exports	653,686	918,691	1,150,000
Domestic shipments	2,925,000[2]	2,931,000[2]	3,030,000[2]
Approximate mine stocks, Dec. 31	3,500,000	3,500,000	3,400,000
Sulphur imports plus sulphur from fuel gases	5,000	12,000	35,000
Non-acid uses of sulphur	770,000	780,000	850,000
Sulphur available for acid	2,160,000	2,163,000	2,180,000
Non-mine stock changes[3]	——	—25,000	50,000
Acid from sulphur	6,985,000	7,104,000	6,880,000
Pyrites imports	180,763	186,507	184,000
Domestic pyrites	788,530	722,596	720,000
Acid from pyrites	1,270,000	1,180,000	1,160,000
Acid from smelters	875,000	873,000	600,000
Acid from hydrogen sulphide	60,000	60,000	60,000
TOTAL sulphuric acid made	9,190,000	9,187,000	8,700,000

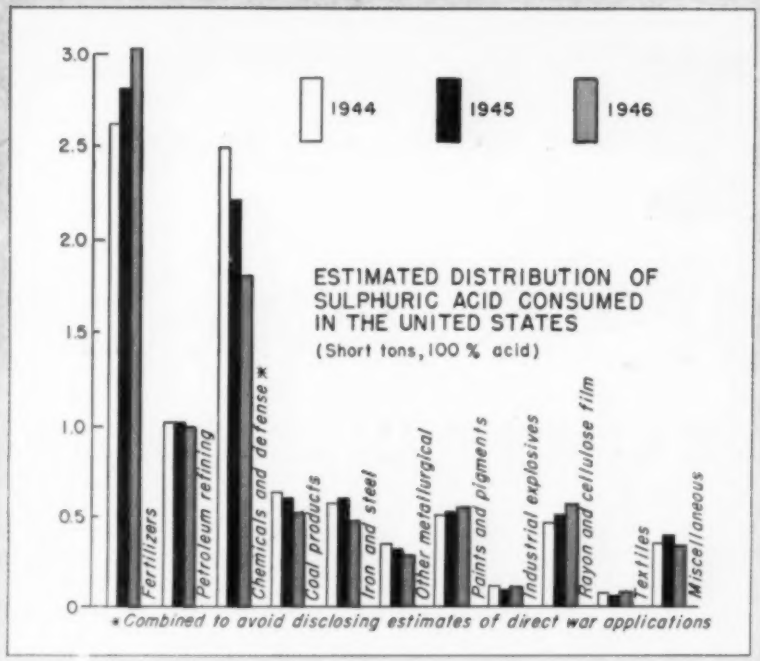
[1]Estimated from 11 months figures. [2]Includes deliveries from distributing points to agree with Bureau of Mines reporting method employing "apparent sales." [3]Changes in users' and consignment stocks, plus producers' stocks at distributing points, except in 1944 when only users' stocks are included.

ment in fertilizer schedules seems inevitable.

Developments within the sulphuric acid industry last year were featured by a sharp drop in production of smelter acid resulting partly from strikes and partly because prices for zinc and copper were not favorable for full operations. There was very little change from the preceding year in the supply of domestic pyrites and imports in the two years were almost identical in volume. Hence greater reliance was placed on crude sulphur and of the total acid produced, that made from crude sulphur accounted for approximately 79 percent as compared with 77 percent in 1945 and 76 percent in 1945.

Sulphur wrote a new chapter into its history of achievement. The amount mined was close to 3,900,000 long tons which is a new yearly record. Shipments from mines were around 4,150,000 long tons, another new high, and exports approximated 1,150,000 long tons—considerably above the total ever before shipped out of the country in a single year. The industry was particularly active in the closing months of the year.

In the accompanying tabulations, revisions have been made for 1944 and 1945 with respect to amounts of acid made from pyrites in those years and also in the tonnage of sulphur allocated for non-acid use. Considerable expansion was reported in non-acid consumption last year with direct soil applications more extensive than hitherto. Larger amounts also went to pulp mills and to producers of carbon bisulphide—even though reported figures for carbon bisulphide production indicate an opposite trend.



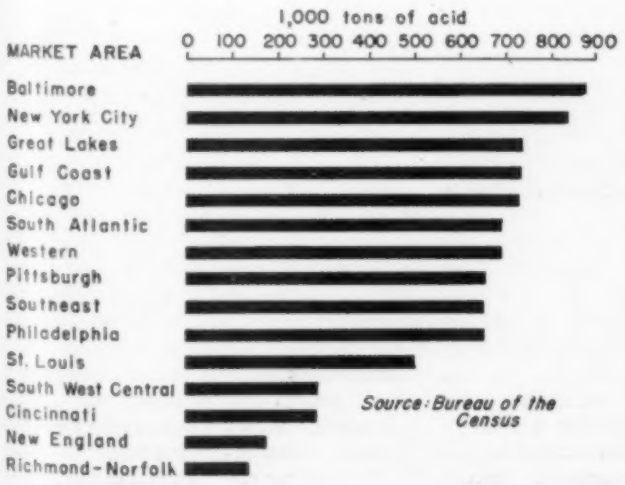
Estimated Distribution of Sulphuric Acid Consumed in the United States

(Short tons, 100 percent acid)

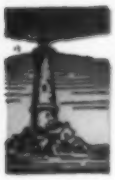
CONSUMING INDUSTRIES	1944 Revised	1945 Revised	1946
Fertilizers	2,640,000	2,850,000	3,020,000
Petroleum refining	1,020,000	1,020,000	1,000,000
Chemicals and defense*	2,490,000	2,200,000	1,780,000
Coal products	625,000	600,000	510,000
Iron and steel	560,000	570,000	475,000
Other metallurgical	350,000	330,000	280,000
Paint and pigments	510,000	520,000	550,000
Industrial explosives	120,000	100,000	105,000
Rayon and cellulose film	450,000	495,000	556,000
Textiles	75,000	70,000	75,000
Miscellaneous	350,000	400,000	345,000
TOTALS	9,190,000	9,175,000	8,696,000

*Combined to avoid disclosing estimates of direct war applications.

DISTRIBUTION OF SULPHURIC ACID PLANTS



Market Area	Contact Plants	Chamber Plants	New Acid Production 1945 (tons)
Baltimore	2	7	876,708
New York City	6	4	843,285
Great Lakes	9	11	734,332
Gulf Coast	9	3	732,263
Chicago	9	5	731,273
South Atlantic	3	36	697,200
Western	14	2	690,466
Pittsburgh	6	5	661,479
Southeast	3	12	657,883
Philadelphia	9	3	657,267
St. Louis	4	2	514,268
South West Central	6	1	281,611
Cincinnati	4	4	279,568
New England	4	2	182,748
Richmond-Norfolk	2	5	146,719
Totals	90	102	8,687,070



Alkali Production Fails to

BASED on the experience of the first complete post war year, requirements for alkalis have grown to a point where they are far in excess of present facilities to produce. During the war productive capacities were expanded but for the most part existing equipment was forced to keep in constant operation in order to narrow the gap between supply and demand. Soda ash, most important of the alkalis from a tonnage standpoint, reached its peak production in 1944 but consuming demand grew at an even higher rate and a system of industry control over distribution was put into effect in order to insure deliveries for essential end uses.

It had been anticipated that the termination of the war would bring a temporary lull in buying pressure and give an opportunity for overhauling over-worked equipment, make necessary replacements, and bring about a higher level in general efficiency. Instead of a lull there came a flood of industry demands which producers attempted to meet by keeping plants as close as possible to capacity rates and by effecting rehabilitation so it would least interfere with production schedules.

Under this handicap and with labor troubles and lack of coal at times curtailing plant operations, ammonia-soda plants turned out about 4,280,000 tons of soda ash last year. This compares with 4,375,017 tons in 1945 and with the 1944 record outturn of 4,538,498 tons. On the other hand production of natural and electrolytic soda ash is moving up with a total of approximately 210,000 tons estimated for last year. In 1945 production from that source was 182,065 tons and in 1944, 179,940 tons. Hence total production of soda ash from all sources was 4,490,000 tons in 1946, 4,557,082 tons in 1945, and 4,718,434 tons in 1944.

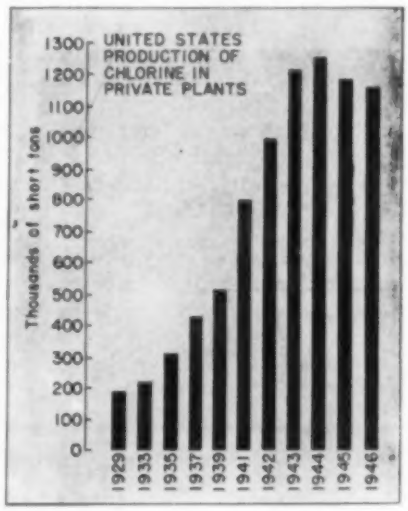
There was considerable change in monthly outputs at ammonia-soda plants last year. While capacity rates generally were maintained, outside factors at times interrupted production, hence total output for the year does not truly represent current capacites. In January, production was 387,012 tons and this was the peak month of the year although in the final quarter the output had climbed close to the January rate. Hence present equipment appears to be able to turn out something over 4,400,000 tons a year. Excess of demand over supply last year has been placed at about 500,000 tons which means that combined natural and ammonia-soda plants must be pointed for a 5,000,000 ton supply without consideration of what future expansions in requirements will be.

Plans for adding new ash capacity last year were delayed when restrictions on types of new building went into force. Later the shortage of ash became so prominent that government approval was given new ash projects and when building restrictions were removed the field was thrown open to all producers. Details regarding all new units, or expansions of existing units, have not been made public but it is reported that work already started or about to be started will mean the addition of nearly 800 tons a day to ash capacity and that this later will be increased by about another 550 tons a day. However it is not expected that much if any of the new plants will be in operation before the latter part of the year. New production of natural ash is expected to double the capacity with a large expansion at an existing works and three new projects said to be planning to enter the field.

Production of Caustic Soda in the United States
(Short Tons)

YEAR*	LIME-SODA	ELECTROLYTIC	TOTAL
1921	163,044	75,547	238,591
1923	314,195	122,424	436,619
1925	355,783	141,478	497,261
1927	387,235	186,182	573,417
1929	524,985	236,807	761,792
1931	455,832	203,057	658,887
1933	439,363	247,620	686,983
1935	436,980	322,401	759,381
1937	488,807	479,919	968,726
1939	532,914	492,132	1,025,046
1940 (est)	505,000	595,000	1,100,000
1941	685,999	743,316	1,429,310
1942	634,291	939,878	1,514,169
1943	663,495	1,036,577	1,700,072
1944	689,565	1,205,039	1,894,604
1945	734,993	1,129,312	1,864,305
1946 (est)	737,000	1,118,000	1,855,000

*Figures for 1921-1945, except 1940 are from the U.S. Bureau of the Census. Prior to 1939 electrolytic caustic soda figures did not include that made and consumed at woodpulp mills, estimated at about 30,000 tons in 1927 and 1929, at about 24,000 tons in 1931, 21,000 tons in 1933, 20,000 tons in 1934, 17,000 tons in 1935, 19,000 tons in 1936 and 1937, and 18,000 tons in 1938



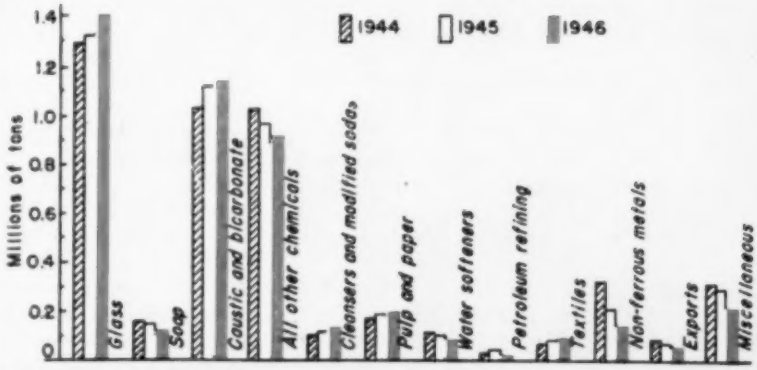
Based on production data for the first 11 months, we have estimated the year's output of caustic soda at 1,855,000 tons which, despite the fact that one plant was strike-bound, probably has not been given full justice to the rate of operations in December. In any case the difference between 1945 and 1946 outputs was very small. Reports of shortages, however, were more frequent last year and it is evident that rising requirements in several different industrial lines are overtaxing present manufacturing facilities. While the deficit in production is not so large as that reported for soda ash, it is large enough to have a retarding effect upon general industrial production.

During the war distribution methods

Meet Requirements

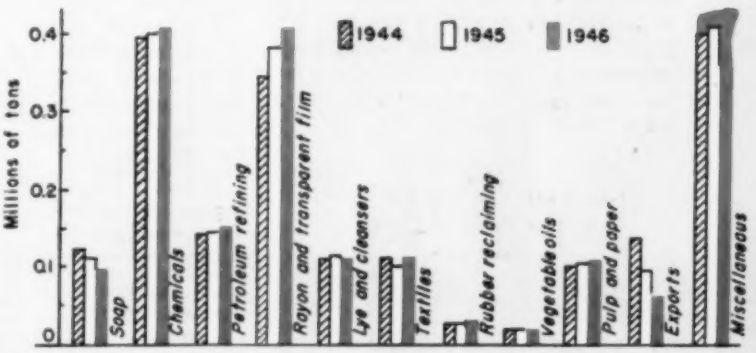
Estimated Distribution of Soda Ash Consumed in the United States

Consuming Industries	1944 Short Tons (Revised)	1945 Short Tons (Revised)	1946 Short Tons
Glass	1,290,000	1,320,000	1,400,000
Soap	162,000	150,000	120,000
Caustic and bicarbonate	1,033,000	1,114,000	1,128,000
All other chemicals	1,025,000	960,000	910,000
Cleansers and modified sodas	100,000	110,000	125,000
Pulp and paper	170,000	175,000	190,000
Water softeners	110,000	100,000	90,000
Petroleum refining	22,000	24,000	20,000
Textiles	61,000	68,000	77,000
Non-ferrous metals	320,000	200,000	140,000
Exports	79,000	70,000	68,000
Miscellaneous	320,000	290,000	222,000
Totals	4,692,000	4,581,000	4,490,000



Estimated Distribution of Caustic Soda Consumed in the United States

Consuming Industries	1944 Short Tons (Revised)	1945 Short Tons (Revised)	1946 Short Tons
Soap	125,000	108,000	90,000
Chemicals	390,000	400,000	405,000
Petroleum refining	140,000	145,000	150,000
Rayon and transparent film	345,000	377,000	408,000
Lye and cleansers	110,000	115,000	110,000
Textiles	110,000	100,000	108,000
Rubber reclaiming	25,000	25,000	26,000
Vegetable oils	18,000	18,000	18,000
Pulp and paper	100,000	105,000	110,000
Exports	121,000	92,000	62,000
Miscellaneous	400,000	415,000	363,000
Totals	1,884,000	1,860,000	1,850,000



were altered and deliveries were made without regard to the number of freight zones crossed. Producers have tried to restore the old order and limit their transactions to former customers and to eliminate long freight hauls. Scarcity of caustic and the fact that some wartime-created consumers had no regular suppliers complicated this adjustment and faced with the possibility of government controls, the industry continues to spread its business but contracts generally cover but 85 percent of the volume actually delivered last year. It is expected that caustic production this year will be increased through the transfer to private operation of the chlorine plants at government arsenals which have been closed since the end of the war. In fact the transfer of those plants already has been partly accomplished and recent estimates hold out hopes for immediate improvement in the supply of caustic and it may be in balance by the end of this year.

Chlorine is expected to have one of the largest expansion potentials in the entire list of chemicals but the drying up of military outlets has not been made up by increased demand from industry. Production last year is estimated at 1,164,000 tons compared with 1,182,000 tons in 1945 and 1,257,500 tons in 1944. These totals refer only to production at private plants. While the chlorine supply was short at times last year in general it proved about ample which was in sharp contrast to the position of soda ash.

Production in 1946 reversed the pattern of 1945 as monthly output for January through July was below that for the corresponding month of 1945 and from August through December was higher in each case than the 1945 monthly totals.

If the rate of monthly production in the final months of last year may be taken as a basis, the industry at the end of the year was set up to produce approximately 1,300,000 tons a year. However, the supply situation for the present year is improved by the probability that negotiations soon may be completed whereby government arsenal plants, now closed, will be reopened under private control and operation.

Synthetic Organic Chemicals

PROSPECTS for synthetic organic chemicals remain undimmed by the decline of production since August 1945. Actual peacetime demand exceeds present production. While some adjustments have necessarily taken place due to curtailed production of certain military chemicals and aviation gasoline, the transition from war to peace has been largely a transition of markets rather than products and processes. Labor troubles, transportation difficulties, and unsettled military and political questions have contributed directly and indirectly to the raw material and equipment shortages that have retarded production and slowed down projected expansion. Specifically responsible for a substantial portion of the over-all drop in 1946, were the extensive steel and coal strikes early in the year. Direct loss of coal-tar crudes was reflected in lowered output of intermediates, and finished products to have a wide reaching effect on the whole synthetic industry. Output of synthetic resins and plastics were reduced by such shortages as formaldehyde, phenol, phthalic anhydride, butyl alcohol and many others. Adhesives, paint and coatings, synthetic fibers and other products based on synthetic resins suffered accordingly. Pentup demand for these products has not decreased.

While a number of new plants went into production during 1946, the year was marked by the projected expansion in diverse branches of the industry. Geographically, new plant construction is under way or being planned for most industrial sections of the country, but much of it is concentrated in the Texas gulf coast area. Significantly, this is further indication of the shifting emphasis to petroleum and natural gas as chemical raw materials. Accelerated by the war, the ready availability and

PRODUCTION OF TOTAL SYNTHETIC ORGANIC CHEMICALS AND PETROLEUM DERIVED CHEMICAL RAW MATERIALS FOR 1943-1946[1]

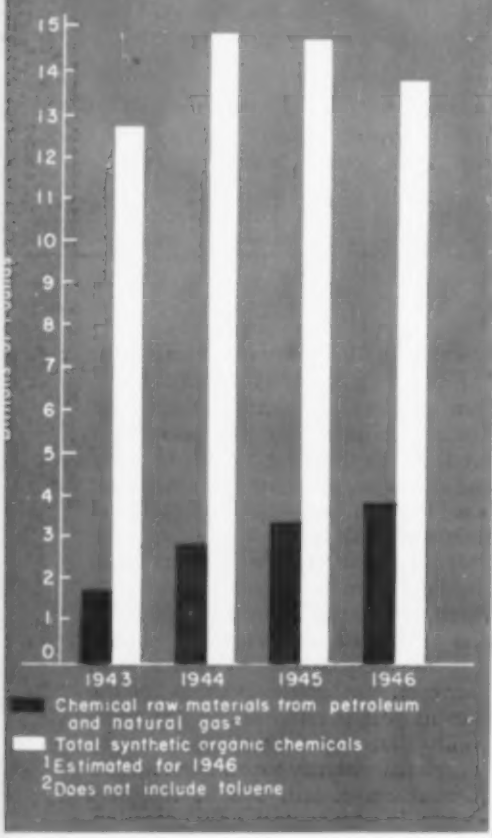


Table I — U. S. Production of Specified Synthetic Organic Chemicals[1]

	1939	1940	1941	1942	1943	1944	1945
Acetic acid (100%)	119,653	186,364	225,671	236,699	292,541	292,611	267,518
Acetic anhydride	181,156	.....	.....	430,634	460,426	495,522	524,748
Acetone	.....	201,506	259,064	338,157	347,624	328,428	307,363
Acetyl salicylic acid	5,372	6,410	8,084	8,650	8,688	9,423	10,941
Butyl acetate, normal (90%)	77,734	86,721	93,227	67,025	64,319	69,987	67,461
Butyl alcohol, normal (100%)	72,737	100,413	129,472	126,190	128,999	150,320	129,364
Carbon bisulphide	.....	.....	240,635	266,765	272,568	291,807	335,056
Carbon tetrachloride	90,536	100,811	121,840	144,595	175,316	209,802	192,826
Chlorobenzene (Mono)	.....	.....	128,854	175,576	220,659	212,455	237,667
Ethyl acetate (85%)	69,897	75,369	94,690	85,542	103,600	108,196	105,814
Ethyl ether	.....	.....	22,646	55,018	65,847	76,192	76,598
Ethylene glycol	.....	.....	151,543	.....	186,834	202,451	205,087
Formaldehyde (37%)	134,479[2]	180,885[2]	309,912	347,463	522,920	522,440	509,602
Hexamethylenetetramine	.....	.....	.....	15,333	24,733	18,309	11,430
Isopropyl alcohol (100%)	179,062	219,926	260,180	351,959	376,065	480,772	490,997
Methanol (100%)	.....	299,000	371,096	414,000	432,000	472,686	493,110
Oxalic acid	10,416	12,921	15,851	15,110	17,150	18,027	20,095
Phthalic anhydride	.....	58,000	81,309	94,807	114,118	122,723	125,033
Phenol	.....	.....	92,922	127,632	181,347	173,141	181,640
Plasticizers, total[3]	29,861	36,903	64,926	99,352	136,153	186,745	169,269
Sulfa drugs, total	.....	.....	2,091	5,435	10,000	4,514	5,888
Surface-active agents, total[3]	.....	.....	27,960	32,025	114,360	152,636	161,540

[1]*From U. S. Tariff Commission and Bureau of Census. All figures given in thousands of pounds.* [2]*Reported as 40% by weight.* [3]*Total of both cyclic and acyclic compounds.*

Table II — U. S. Production of Cyclic Synthetic Organic Chemicals[1]

	1939	1940	1941	1942	1943	1944	1945
Intermediates	607,175	805,807	1,007,426	1,272,384	1,637,275	2,143,305	2,188,643
Dyes	120,191	127,834	168,657	151,878	144,013	151,653	144,296
Color lakes and toners	18,154	19,213	26,272	17,178	16,317	19,197	22,570
Medicinals	15,188	18,214	31,303	38,298	51,633	35,353	39,068
Flavors and perfumes	5,349	5,485	11,506	11,536	9,559	11,726	12,691
Rubber processing chemicals	29,966	37,139	42,928	36,536	61,710	73,774	80,080

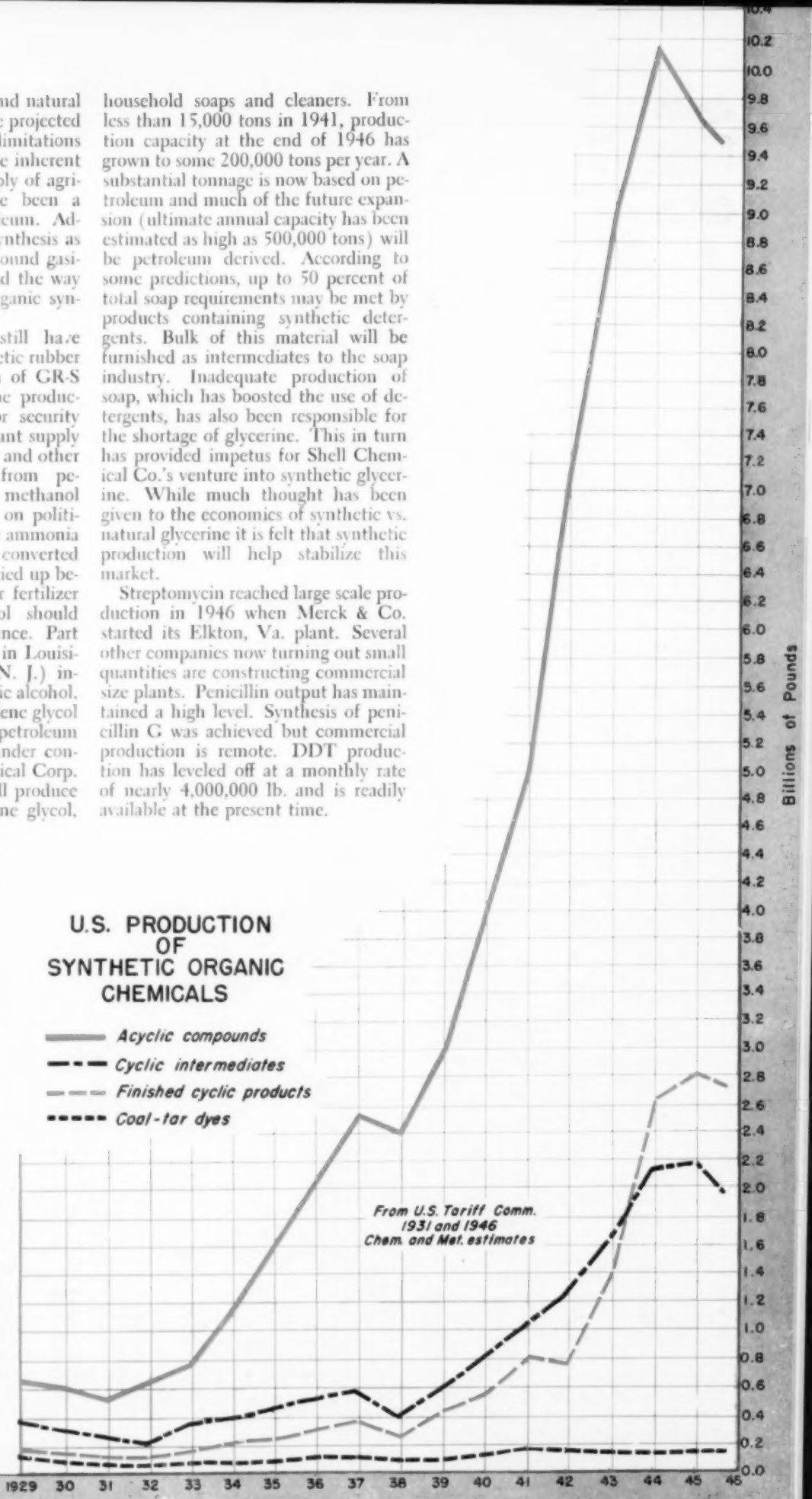
[1]*From U. S. Tariff Commission and Bureau of Census. All figures given in thousands of pounds. Cyclic compounds shown in this table are mostly derived from coal-tar.*

stable supply of petroleum and natural gas has attracted much of the projected capacity in this field. Basic limitations of the coal-tar supply and the inherent fluctuation of price and supply of agricultural raw materials have been a factor in this shift to petroleum. Advances in Fischer-Tropsch synthesis as well as the work on underground gasification of coal may well lead the way to new raw materials for organic synthesis.

Political considerations still have major influence on the synthetic rubber program. While production of GR-S will undoubtedly drop, some production will be maintained for security reasons, even with an abundant supply of natural rubber. Butadiene and other intermediates will come from petroleum. Alleviation of the methanol shortage depends somewhat on political considerations. Synthetic ammonia plants which can be readily converted to methanol production are tied up because of the world needs for fertilizer materials. Synthetic alcohol should continue to gain in importance. Part of the expansion under way in Louisiana by Standard Oil Co. (N. J.) includes a new unit for synthetic alcohol. Production facilities for ethylene glycol and related chemicals from petroleum by two new producers are under construction. Wyandotte Chemical Corp. entering the organic field will produce mixed ethylene and propylene glycol, chloroether, polyglycols, etc. Jefferson Chemical Co. will use refiner gases to produce ethylene glycol and other intermediates at Port Neches, Tex., and one of its parent companies, American Cyanamid Co., will utilize these intermediates in an adjoining plant to produce a variety of industrial chemicals. Breaking away from coal-tar, phthalic anhydride is now being made from petroleum derived ortho xylene by the Oronite Chemical Co., in California. In view of the many pressing needs for naphthalene it is probable that any future expansion of production capacity will utilize petroleum.

One of the fastest growing classes of compounds are the synthetic detergents. First manufactured for industrial use, synthetic detergents have become important as ingredients in household soaps and cleaners. From less than 15,000 tons in 1941, production capacity at the end of 1946 has grown to some 200,000 tons per year. A substantial tonnage is now based on petroleum and much of the future expansion (ultimate annual capacity has been estimated as high as 500,000 tons) will be petroleum derived. According to some predictions, up to 50 percent of total soap requirements may be met by products containing synthetic detergents. Bulk of this material will be furnished as intermediates to the soap industry. Inadequate production of soap, which has boosted the use of detergents, has also been responsible for the shortage of glycerine. This in turn has provided impetus for Shell Chemical Co.'s venture into synthetic glycerine. While much thought has been given to the economics of synthetic vs. natural glycerine it is felt that synthetic production will help stabilize this market.

Streptomycin reached large scale production in 1946 when Merck & Co. started its Elkton, Va. plant. Several other companies now turning out small quantities are constructing commercial size plants. Penicillin output has maintained a high level. Synthesis of penicillin G was achieved but commercial production is remote. DDT production has leveled off at a monthly rate of nearly 4,000,000 lb. and is readily available at the present time.



Alcohol and Solvents

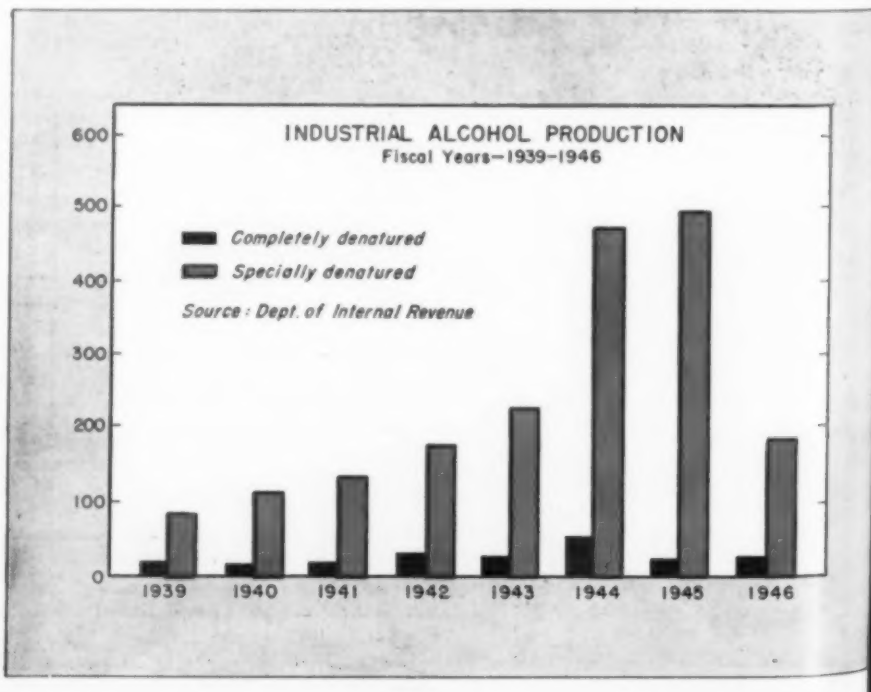
IN THE EARLY part of last year fermentation alcohol producers were uncertain about raw material supplies because negotiations between Cuba and the Commodity Credit Corp. struck several snags before the contract actually was signed in Havana in July. It provided for a two-year purchase of sugar, blackstrap, and industrial molasses alcohol at fixed prices. Under the terms, during 1946 the United States was to purchase, in addition to sugar, 115 million gallons of molasses at 13.6c. per gal., f.o.b. Port Terminal, and 40 million gallons of 190 proof alcohol at 65c. per gallon. As 30 million gallons of molasses were earmarked for normal butyl alcohol, the original allocation did not provide more than 30 million gallons of alcohol by fermentation plus the 40 million gallons imported and the 80 million gallons held in the government stockpile. Hence the total available supply, not including grain and synthetic alcohol, was approximately 150 million gallons with an estimated demand of 170 million. The actual production from all sources was about 173 million gallons.

Producers of synthetic alcohol turned out about 65 million gallons but virtually none of this came on the open market so that alcohol was in short supply with the exception of that made from grain.

Due to increased demands in the rubber field, which had not been anticipated by the Rubber Reserve Corp. earlier in the year, the rise in production of butadiene cut sharply into the government stocks of alcohol. In an effort to protect the position of normal consumers, CPA took action resulting in an agreement whereby Rubber Reserve was able to buy 20 million gallons of alcohol and a supply of 60 million gallons was set aside for alcohol and solvent consumers. This stockpile was liquidated in the late fall and plants again were forced to use grain as a raw material. Since this represented a big increase in cost the price for alcohol was raised 28.5c. per gal. in a single day bringing it to a basis of 85.1c. per gal. f.o.b. plants. Later some relief was found as a result of the shipping strike which prevented sending abroad the molasses allocated under UNRRA and this molasses was sold to fermenters.

Reports on production of ethyl alcohol as issued by the Bureau of Internal Revenue cover fiscal years ended June 30. For the 1945-46 year the Bureau places production at 348 million gallons with 408 million gallons withdrawn for denaturation. The excess of withdrawals over production is accounted for by a difference in terminology whereby the output at distilleries is referred to as spirits while withdrawals for denaturation are classified as alcohol whether originally produced as alcohol, spirits or unfinished spirits.

Production in the 1945-46 period is the lowest reported since the 1940-41 year and marks the first break in the upward curve in production since 1938-39. The peak fiscal-year output at industrial alcohol plants was in 1944-45 when production amounted to 683 million proof gallons with withdrawals for denaturation reaching 971 million proof gallons, thus indicating a supply of 288 million gallons obtained outside industrial alcohol plants. Production of denatured alcohol in 1945-46 was reported at 213 million wine gallons of which 26 million gallons was completely denatured and 187 million gallons specially denatured. While there was an increase in the amount of completely denatured during the war period, the rise was moderate with the maximum of 52 million wine gallons reported for 1943-44. Hence the greater part of the expanded alcohol supply went into specially denatured. Synthetic rubber was the most important factor in forcing the expansion as in 1944 almost 316 million wine gallons or about 64 percent all specially denatured produced went to the rubber industry. In 1943, 20 million wine gallons filled requirements for rubber.



Producers of synthetic methanol were relieved from the obligation of filling military orders but still had to turn out ammonia for the fertilizer market. Strikes caused the loss of a month's production in the spring and a two-weeks loss in the late fall. In spite of this handicap, production for the year was approximately 72 million gallons. War Assets Administration conducted negotiations to dispose of government plants but as the terms required plants to produce ammonia for at least two years, there has been no help in the methanol situation from these facilities.

Wood distillers sought to keep plants going at capacities but were not able to match the 1945 production total of a little more than 2,800,000 gallons of natural methanol. The 1946 production is estimated at about 2,340,000 gallons. Because of the shortage of synthetic methanol for anti-freeze, more completely denatured ethyl alcohol was released to that trade in the final months. This accounts for the fact that virtually all natural methanol production was sold as denaturing grade rather than for anti-freeze.

Higher Alcohols

Under normal conditions, the largest part of normal butyl alcohol is produced by fermentation. Due to difficulty in getting raw materials, fermenters could not maintain capacity rates. It is estimated that production for the year was approximately 16 million gallons which fell considerably below consuming demands. It is reported that a large part of synthetic butyl alcohol was used in the manufacture of plasticizers and as anticipated new facilities did not materialize, normal butyl alcohol and acetate were difficult to obtain. Due to the shortage of these products as well as to a wide price differential, secondary butyl acetate was in active demand but again the supply was inadequate as the greater part of secondary butyl alcohol production was used in producing methyl ethyl ketone. Production of methyl ethyl ketone was about the same in volume as in the preceding year but the year closed with producers having a large number of unshipped orders.

Although all isopropyl alcohol plants operated at capacity last year they were not able to turn out enough to take care of the demand. It had been anticipated that additional capacity would get into operation, but the many problems connected with construction proved to be a real handicap and only one plant got into production and then only in the latter part of the year. The shortage of isopropyl also had an effect on the acetone market where demand for domestic use and for export was far ahead of the availability of supplies. Producers of synthetic acetone were able to keep plants going at capacities but fermenters were not able to obtain sufficient raw materials and their outputs fell below normal capacities.

Production of Ethyl Alcohol

Fiscal Years Ended June 30

1,000,000 Proof Gallons

	1939	1940	1941	1942	1943	1944	1945	1946
Production*	201	244	299	425	448	637	683	348
Withdrawn for denaturing†	176	223	274	375	408	973	971	408
Withdrawn tax-paid	22	24	28	25	6	6	28	47
Stocks, June 30	31	22	10	28	210	125	141	104

Denatured Alcohol

1,000,000 Wine Gallons

Production	101	127	154	208	223	524	527	213
Completely denatured	17	15	18	29	24	52	33	26
Specially denatured	84	111	136	179	223	472	494	187

*Production at industrial alcohol plants. †Represents products withdrawn as alcohol whether originally produced as alcohol, spirits, or unfinished spirits.

The Outlook

Present indications are that 1947 will find supply and demand for solvents out of line to a greater degree than at any time since the middle of the 1920's. Last year production was at capacity rates with consuming demands tempered by strikes in consuming industries. If consumers are less restricted this year, requirements for solvents will be higher and producers are worried about the supply position as increased facilities are not expected to be ready for operation before the latter half of the year.

In the case of ethyl alcohol, contracts made with Cuba provide for the receipt of 165 million gallons of blackstrap molasses and 20 million gallons of alcohol in 1947. It is understood this alcohol will go into government stockpile. After molasses for fermentation butyl alcohol has been deducted, not more than 50 million gallons of ethyl alcohol will be produced and the deficit in requirements must be made up by using other raw materials such as potatoes, and grains.

While additional facilities for production of synthetic alcohol have been announced by a new producer, it is not anticipated they will be in production much before the latter part of the year and the output indicated is not substantial in terms of the alcohol shortage.

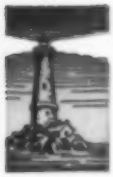
As a result of high-priced alcohol, producers who formerly used ethyl alcohol as a source of ethylene turned to ethyl ether so that while two years ago ethyl ether was considered a problem by the synthetic alcohol producers, today demand far exceeds supply.

A number of new facilities are being completed for methanol. It is understood these plants will produce in the latter part of the year but not in time to help in filling anti-freeze demands. Isopropyl alcohol may offer some help but at present the greater part of such production is going into acetone, anti-freeze, and chemicals. Shortage of molasses extends to European markets and this has served to increase attempts to buy acetone in this country.

While normal butyl alcohol undoubtedly will be as difficult to obtain in 1947 as it was in 1946, the real shortage is in high-boilers. At present, production of amyl acetate is confined to one company turning out a synthetic product and using a large part of it for specialized use other than for protective coatings.

During the past year, considerable publicity has been given to the Fischer-Tropsch process as a source of alcohols and solvents as well as other chemical raw materials. Informed opinion indicates that considerable work still is to be done on the process and in any event that it will not be a factor in the solvent business for at least two years.

Looking beyond this year it would appear that facilities now under construction are sufficient to create a balance between supply and demand for solvents in 1948.



Fertilizer Chemicals Lag World Demand

World Production and Consumption of Fertilizer Nitrogen (Thousands of Metric Tons of Nitrogen)

	1945-1946		1938-1939		1937-1938	
	Production	Consumption	Production	Consumption	Production	Consumption
Canada	179	21	49.5	10	51.5	9.5
U. S. A.*	520	611	188	332	185.5	327
Chile	254	5	225	5	224	5
America other and West Indies	1	28	1	38	1	23.5
Australasia	7	17	6	14	4.5	15
Japan	80	80	425	419.5	416.5	454.5
China	10	10	1	30	1	28.5
India-Ceylon	6	45	5	29.5	5	26.5
Other Asia	..	8	..	44	..	42.5
Egypt	..	65	..	77.5	..	76.5
Other Africa	..	11	..	18.5	..	19.5
United Kingdom	248	166	128	68.5	135	68
Norway	91	23	85	11	85.5	10
Belgium	87	90	84	53.5	82.5	54.5
Holland	25	80	105	95	104.5	86.5
France	70	220	150	184	148.5	175
Other Europe†	300	400	1,090	1,026	937	975
Total†	1,878	1,880	2,542.5	2,456	2,382	2,397

Source: British Sulphate of Ammonia Federation, Ltd.
*Including Puerto Rico and Hawaii.† Exclusive of U.S.S.R.

MANUFACTURE of fertilizer chemicals reached a record rate in the U. S. at the end of 1946. Nitrogen, potash, and superphosphate all promise to make a still higher record in 1947. There seems almost no limit on the world's ability to absorb them.

The fertilizer business is now a world-wide activity. Since fertilizer means food in any language there remains for a while longer the need for some international, governmental control of fertilizer supply as a means for actual support of life in many areas. And, as in the war period, America remains the major source of supply. In fact if there were not American controls on export there would be much less than an adequate supply of fertilizer chemicals left in the U. S. currently.

Domestic demand also continues at a record high for actual purchases by farmers. Extremely high farm income, agronomic education of farmers, and patriotism in food raising, have combined as a trio of super salesmen who remain very much on the job even now. And the Department of Agriculture for its soil conservation program continues to seek for this "give away" land-restoration service much greater quantities of fertilizers than can be spared for these purposes.

With the prospect of at least two more years of huge farm income there seems no doubt that there remain at least two more years of equally impressive fertilizer demand.

Nitrogen Chemicals

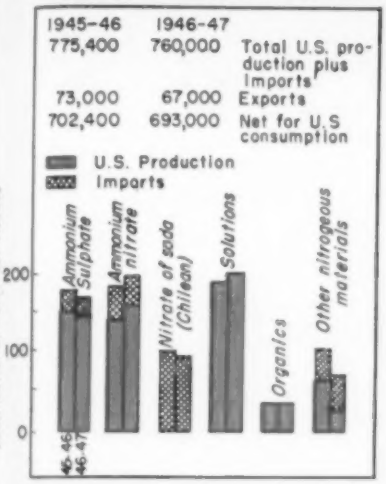
At the beginning of 1947 the nitrogen-products industry was operating at near capacity both in privately owned or leased and in government controlled nitrogen fixation plants. All ten of the wartime plants built for explosive purposes with government funds are functioning for peacetime production of nitrogen fertilizers. Some years ago one of these arsenals was transferred to Tennessee Valley Authority, its builder and wartime operator. The arsenals at South Point, Ohio, and Sterlington, La., have been sold by Uncle Sam to Allied and to Commercial Solvents, the wartime builders and operators. Leased with option to buy by their wartime operators are Lake Charles, Ozark, and Jayhawk arsenals by Mathieson, Lion Chemical, and Spencer Chemical, respectively.

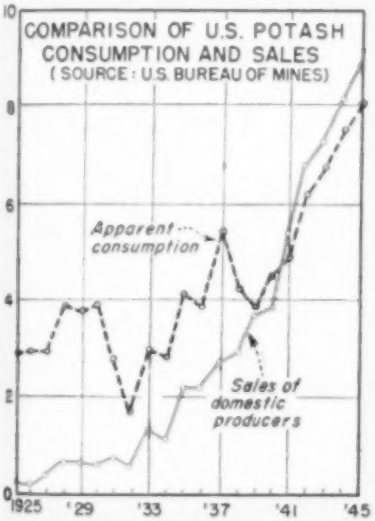
Remaining under Ordnance ownership and control are the other four arsenals at Morgantown, West Henderson, Texas Panhandle, and Missouri. These four are currently being operated for the Army account to make ammonia for ammonium nitrate export to occupation areas by Heyden Chemical, Allied, Spencer, and Hercules.

The wartime necessity for a concentrated nitrogen fertilizer which could be made most effectively has firmly established ammonium nitrate as a usable fertilizer when suitably grained and coated. That chemical is now the product made in largest quantity from the ammonia produced at almost all of the ten wartime plants. It, therefore, constitutes at present by far the largest single chemical product of ammonia synthesis used directly as made. Most of the rest of the fertilizer ammonia synthesized is used for ammoniation of superphosphate.

The shipment of ammonium nitrate to our armies of occupation has caused one of the most serious fertilizer-supply problems of recent years. The army had shut down its arsenals and declared most of them surplus without any thought of the necessity of maintaining fertilizer flow into devastated areas to provide for reestablishing agri-

CURRENT NITROGEN SUPPLY





U.S. Phosphate Rock Industry
January-June, 1946
(Long Tons)

	Phosphate rock	P_2O_5 content
Production (mined)	3,283,179	1,066,615
Sold or used by producers:		
Florida:		
Land pebble	2,246,595	754,783
Soft rock	49,025	10,229
Hard rock	55,432	20,182
Total, Florida	2,351,052	785,194
Tennessee[1, 3]	726,149	210,552
Idaho	109,658	34,424
Montana	84,241	27,250
Virginia	(1)	(1)
Total, United States	3,271,100	1,057,420
Stocks in producers' hands, June 30:		
Florida	503,000	169,000
Tennessee[1, 3]	331,000	91,000
Other	19,000	6,000
Total stocks[2]	853,000	266,000

Source: U.S. Bureau of Mines.
[1]Virginia included with Tennessee. [2]Includes brown-rock matrix of sinter grade and sintered brown-rock. [3]Does not include plant stocks of washer-grade matrix.

culture and feeding of both enemy and allied peoples. Suddenly it found that it had lost control of the situation. It then proceeded to grab away from American agriculture large supplies of nitrogen chemicals which were needed in the United States. The combined efforts of farm organizations and the fertilizer industry were necessary to help the Department of Agriculture put the army in its place. But the deficit abroad was so serious that a majority of the arsenal output was taken with the promise that the product would be repaid in kind before the spring planting season of 1947. That promise is being kept only partially.

The future of these nitrogen plants is gradually becoming clear. Those which make ammonia with hydrogen produced from natural gas are likely to continue in operation. Those which use coke as the primary raw material are likely to be shut down in part by higher costs so imposed. The three plants under lease with option to buy are likely to be purchased outright by the present operators within a few years. Long term leases seem likely on some, but not all, of the four currently operated for the Army under emergency short-term leases. Negotiations are in progress for two of the four. The other two are high-cost producers and will probably be put in standby condition and later cannibalized.

Superphosphate Active

Superphosphate continues to be the major component of all mixed fertilizer. Demand for it continues to exceed supply partly because of the shortage of rock and partly because of the shortage of sulphuric acid with which to treat the rock. Scarcity of railroad cars was in some areas the bottleneck in the supply system even after the superphosphate and mixed fertilizer were made. All of these problems seem likely to continue as serious factors during the coming season.

Production of superphosphate during the past year has been at the rate of 650,000 to 700,000 short tons per month (calculated as 18 percent P_2O_5). In few cases has there been any stockpiling by producers of the normal grades. Supplies have been moved promptly into the distributing system except where scarcity of nitrogen compounds for mixing has prevented such movement.

Production of double superphosphate (the 45 percent P_2O_5 grade) has continued also at fairly high levels during 1946. Typical production that year was approximately 30,000 short tons per month.

New capacity for production of phosphate rock is being developed by established producers of Florida. Some effort at western phosphate production has continued; but no important influence on national supply has yet resulted from these new efforts.

Kaiser activities at Permanente are yielding on a scale of 150 to 200 tons per day a fused product of phosphate rock and serpentine. A similar project using phosphate rock and olivine is at pilot-plant stage as a result of investigations at the Univ. of Washington done for the Oregon Manganese Development Co. Preliminary agronomic studies indicate that both of these new products give good performance in acid soil.

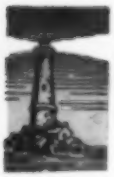
New Potash Record

Potash production at the beginning of this year is at the rate of approximately 920,000 tons of K_2O annually. This is about 7 percent above the rate of production a year ago. Almost all of this output comes from the five major mining enterprises, three at Carlsbad, one at Trona, and one at Salduro, Utah. About 1 percent of the total comes from byproduct sources, which include cement production, distillery wastes, and a new potash recovery from certain brines being developed by Dow Chemical in Michigan.

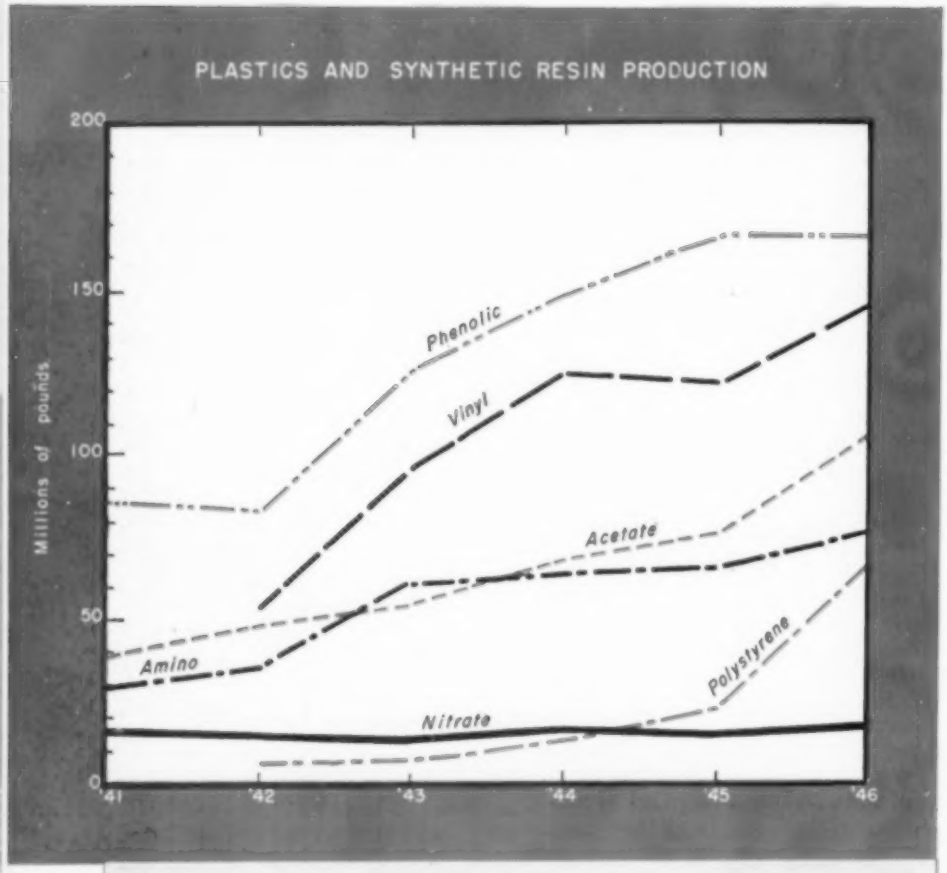
Several of the companies have increased potash refinery capacity during the past year; and some increases of hoisting capacity have been made. Additional increases in facilities are under construction or planned, principally those of American Potash and Chemical Co. under its new management, Heyden Chemical.

Deliveries of potash reported by American Potash Institute continue to be over 90 percent for agricultural usage, principally in the United States. Most of the balance is for chemical products. The exports go about half to Canada and the balance to American Territories, Cuba, and elsewhere in Latin America.

The international control of potash continues to make the two hemispheres more or less independent of each other. Most recent of such developments is the supply of Japan and Korea by potash from the Russian zone of Germany. This has relieved American producers of meeting that Oriental demand in the occupied areas which is the responsibility of the United States. The industry notes with interest that this supply of potash to the Orient from the Russian zone is at a price of approximately twice the prevailing rate for K_2O in the United States.



Plastics and Synthetic Resins



U. S. Production of Plastics and Synthetic Resins

1941-1946

Pounds

	Acetate[1]	Nitrate[2]	Phenolic[3]	Amino[4]	Vinyl[5]	Polystyrene
1946[6]	103,000,000	18,000,000	166,000,000	77,000,000	144,000,000	64,000,000
1945	76,637,000	15,235,000	165,156,000	65,797,000	122,507,000	22,794,000
1944	65,023,000	15,951,000	148,650,000	62,484,000	126,892,000	10,571,000
1943	54,386,000	14,042,000	126,173,000	59,859,000	95,564,000	6,737,000
1942	48,246,000	15,129,000	82,466,000	34,830,000	52,156,000	6,965,000
1941	37,101,000	16,497,000	84,432,000	28,216,000	.....	.....

Data based on material compiled by United States Tariff Commission. [1]Includes cellulose acetate and mixed ester plastics, fillers, plasticizers, and extenders. [2] Includes fillers, extenders and plasticizers. [3]Excludes protective coatings, fillers, extenders, and plasticizers. [4]Includes urea and melamine resins. Excludes protective coatings, extenders, plasticizers and fillers. [5]Includes sheeting and film, textile and paper coating resins, molding, adhesives, and protective coatings. [6]All 1946 production estimates are based on eleven-month production figures compiled by the Bureau of the Census

OVERCOMING many obstacles the plastics industry continued to grow at a healthy rate during the past year. A study of the larger gains of the year shows that polystyrene production rose from 27.8 million pounds in 1945 to 64 million pounds. Vinyl resin production surged up to a new high of 144 million pounds. Ethyl cellulose and related plastics reached an estimated annual output of 12 million pounds while other resins maintained a steady growth.

It is anticipated that when the presently planned expansion programs are completed this year basic production facilities will have an annual capacity of 1.6 billion pounds. Despite these increases in production, the large gap that still exists between fabricating and molding capacity and the available supply of plastic materials is likely to continue for a number of years because planned new additions to production capacities will be outstripped by increases in consumer demand. Expansion plans were retarded in 1946 by shortages of materials to manufacture resins and molding powders. Plasticizers, phenol and urea were in short supply with no relief in sight this year. Cellulose acetate plastics plants have not been operating at capacity due to difficulties in obtaining sufficient flake. However, they are operating above the wartime rates. The shortages were due to a number of factors such as difficulties in obtaining materials and equipment needed for producers expansion programs, and labor disputes in steel, coal and plastics industries.

Tariff Commission reports issued last year show that protective coatings have grown to a point where they consumed 303 million pounds of resin in 1945. In the case of alkyd resins 148 million pounds went into protective coatings from the 188 million pounds produced in that year.

An important new plastic called Teflon, tetrafluoroethylene, was formally announced last year.

Rayon and Synthetic Fibers

As the synthetic fiber industry enters its second postwar year the accent is on both expansion of capacity for fiber production, and the improvement of techniques for better dimensional stability. The industry is also interested in special effects with resin coatings, blending of fibers to produce increased strength, and improved water repellent properties of fabrics. To show how far textile coatings have progressed, the Bureau of the Census reports that in November 1.4 million pounds of urea and melamine resins and 3.7 million pounds of vinyl resins were used for textile and paper coatings.

American rayon producing capacity is expected to increase 26 percent by the end of 1948, with a capacity of 1 billion pounds reached by the end of 1947, against a present annual capacity of 891 million pounds. In reporting this expansion program the *Rayon Organon*, official statistical reporter of the industry, said that the increase in rayon output will come from the extension and remodeling of existing plant equipment as well as from new rayon plants being built by American Enka Corp. at Lowland, Tenn., and by the Celanese Corp. of America at Rock Hill, S. C. Capacities of two other proposed rayon plants, one of American Viscose Corp. and the other of Industrial Rayon Corp., are not included in the survey since they will not be in operation by the fall of 1948.

U. S. 1946 output of rayon was about 854 million pounds as compared with its previous high of 792 million in 1945, based on figures assembled by Textile Economics Bureau, Inc., and published in the *Rayon Organon*. An examination of the consumption of yarn shows that 483 million pounds of viscose and cupra yarn was consumed as compared with 433 million in 1945. Exports of yarn are estimated at 12 million or 8 million pounds lower than 1945. Stocks on hand at the end of the year are estimated at 6.0 million pounds of yarn, with the staple stocks at 1.6 million. Study of rayon staple indicates that 208 million pounds was consumed with 132 million pounds of that total produced by the viscose and cupra processes. Staple imports of 33.2 million pounds are estimated to have been the highest on record with the exception of 1939.

Rayon yarn shipments to tire manufacturers have grown rapidly from 55.6 million pounds in 1943 to 187.4 million pounds in 1945 and an estimated more than 200 million pounds in 1946. By the end of the first quarter of 1946 rayon had supplied 42 percent of the total tire cord and fabric produced in that period.

Other synthetic fibers have been growing. Nylon capacity will be increased next year with the completion of another new plant at Chattanooga, Tenn. While no figures are available on 1946 production, *Rayon Organon* states that in 1944 64.4 million linear yards of nylon fabric was produced compared with 42.8 million linear yards in 1945. Vinylidene and vinyl fibers have proved successful in industrial fabrics and they will soon be used for household fabrics. Terylene is the name of a new synthetic fiber being developed by Imperial Chemical Industries. It is derived from ethylene glycol and terephthalic acid. However, this yarn is not expected to be available for some time.

Production of Rayon Filament Yarns[1] (1,000 lb. Units)

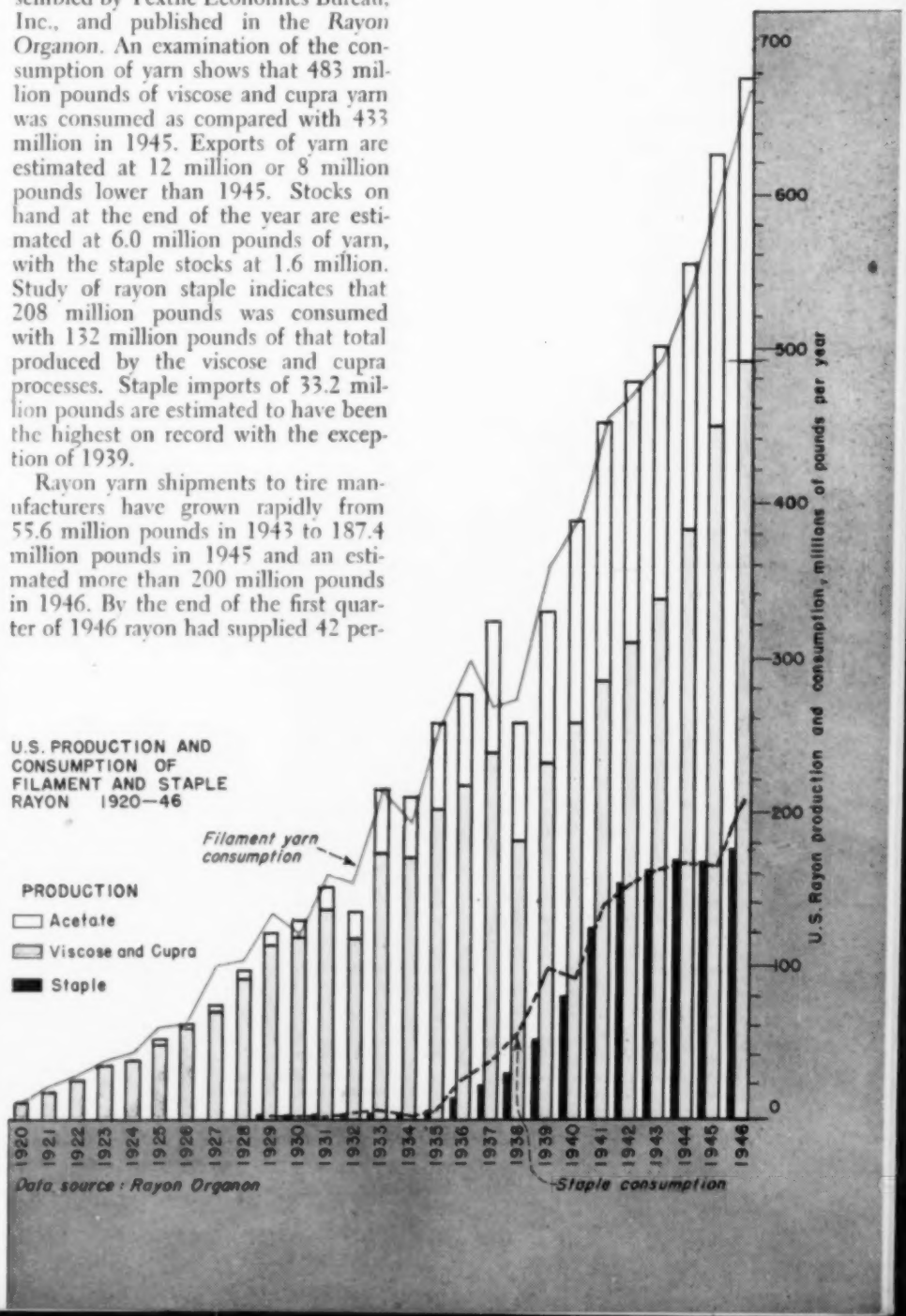
Year	U.S. Production	U.S. Export Balance[2]	World Production
1923	34,960	—3,029	102,990
1925	51,050	—5,293	185,290
1927	75,555	—14,633	295,095
1929	121,400	—14,832	434,215
1931	150,880	—1,490	499,665
1933	213,500	176	663,395
1935	257,555	2,193	941,055
1937	321,680	525	1,203,105
1939	328,625	1,703	1,150,425
1940	390,070	1,440	1,183,760
1941	451,205	[3]	1,267,025
1942	479,330	5,600	1,213,170
1943	501,125	9,500	1,165,885
1944	555,215	16,300	1,039,630
1945	625,000	23,000	1,000,000
1946	677,000		

[1]From Rayon Organon. Does not include staple which is estimated at 350,000 lb. in 1930; 880,000 lb. in 1931; 1,100,000 lb. in 1932; 2,100,000 lb. in 1933; 2,200,000 lb. in 1934; 4,600,000 lb. in 1935; 12,300,000 lb. in 1936; 20,244,000 lb. in 1937; 29,861,000 lb. in 1938; 51,300,000 lb. in 1939; 81,098,000 lb. in 1940; 122,026,000 lb. in 1941; 153,285,000 lb. in 1942; 162,019,000 lb. in 1943; 168,740,000 lb. in 1944; 171,000,000 lb. in 1945; and 178,000,000 in 1946.

World staple estimated at 6,100,000 lb. in 1930; 52,700,000 lb. in 1934; 139,900,000 lb. in 1935; 299,000,000 lb. in 1936; 619,000,000 lb. in 1937; 958,000,000 lb. in 1938; 1,082,000,000 lb. in 1939; 1,280,000,000 lb. in 1940; 1,492,000,000 lb. in 1941; 1,537,000,000 lb. in 1942; 1,467,000,000 lb. in 1943; 1,117,000,000 lb. in 1944; and 700,000,000 lb. in 1945.

[2]Import balance does not include staple; minus sign indicates net exports; staple imports 12,721,000 lb. in 1936; 20,614,000 lb. in 1937; 23,197,000 lb. in 1938; 47,403,000 lb. in 1939; 17,736,000 lb. in 1940; and 11,600,000 lb. (est.) in 1941.

[3]No data available.



Vegetable Oils and Fats

OUTSTANDING economic event in fats and oils in 1946 was the new high record for prices set during the latter part of the year, when OPA controls were removed. Previous peak, reached in November 1919, was exceeded by about 20 percent, and the general level of domestic fats and oils prices at the year-end was about three times prewar levels.

World supply of fats and oils for the calendar year 1946 was about 18 million tons. This compares with 21.6 millions tons average in the period 1935-39. Net quantity available for world export trade was about 3 million tons, compared with 6.5 million in prewar years.

Production of fats and oils in U. S. from domestic raw materials in the calendar year 1946 reached something less than 9 billion pounds, representing a drop of over 5 percent from the previous year. Stocks of fats and oils also dropped from the preceding year to a point only two-thirds the normal prewar level. On October 1, factory and warehouse stocks reached a low of 1.2 billion pounds, a point much lower than desirable for most comfortable working inventories.

Outlook for 1947

Between 10.5 and 11 billion pounds of fats and oils would be consumed in the United States in 1947, according to official estimates, if supplies were unlimited and there were no restrictions. Actually the 1947 supply is estimated to be about 9 billion pounds, leaving a deficit of over 1.5 billion.

Although shipments of fats and oils were large during the closing months of 1946, there was little apparent effort to hold back in the interest of uniform distribution throughout the coming year. When the winter crushing peaks have been passed, and supplies begin to dwindle, repetition of 1946 shortages may be anticipated during later 1947 until the new crop are harvested.

Prices will undoubtedly stay near their present levels unless there is a general business or price recession, at least until the 1947 oilseed crops begin to mature. The probable acreage of oilseed plantings, according to the 1947 crop goals, may yield over 10 billion pounds. Of course this will not all be available in 1947, but the effect on prices may be evident late in the year.

Announcement of a support price of $6 per bushel for flaxseed to be planted in 1947 represents a new high in inducements to increase domestic drying oil production. Although this will affect the area which has wheat as its major crop, flax will probably be increased considerably above former levels without unduly curtailing the world's wheat production. With normal weather, a large supply of linseed oil should materialize.

As a result of international commitments, only about 200 million pounds of fats and oils are expected to be imported into the U. S. in 1947. Although this country is the normal market for a larger quantity than that, the recommendations of the International Emergency Food Council and related international programs will keep U. S. imports well under the billion pounds which might otherwise have materialized.

As long as import and export controls continue, a true free-market price level cannot be reached. Congressional policy on world trade controls may be reached during 1947, but in January the foreign trade policy of the new Congress was not yet clear.

FATS AND OILS PRODUCTION FROM DOMESTIC MATERIALS (MILLION POUNDS)

Crop Year	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47 Estimates	[2] 1947-48 Estimates Based on Goals
Cottonseed oil	1,250	1,401	1,236	1,324	1,017	1,000	1,250
Soybean oil	707	1,206	1,219	1,333	1,410	1,350	1,590
Linseed oil	546	729	724	536	522	400	800
Peanut oil	77	131	135	107	99	125	125
Other veg. oils	252	255	222	234	191	235	235
Lard & rendered pork fat							
Inspected	1,700	1,944	2,541	1,375	1,364	1,300	1,550
Other	740	890	880	831	811	800	850
Total	2,440	2,834	3,421	2,206	2,175	2,100	2,400
Butter:							
Creamery	1,779	1,725	1,510	1,420	1,109	1,200	1,530
Farm	370	347	331	330	331	350	370
Total	2,149	2,072	1,841	1,750	1,440	1,550	1,900
Tallow & grease	1,733	1,626	1,941	1,765	1,714	1,800	1,800
Other animal fats	297	290	232	220	155	170	170
Fish oils	216	165	172	200	170	125	125
Total	9,667	10,709	11,143	9,675	8,893	8,855	10,395

[1] Following assumptions made in developing estimates: cotton crop, 8.5 million bales; soybean crop, 192 million bushels, 154 million bushels crushed, 9 pounds of oil per bushel; flaxseed, 24 million bushel crop; lard, 81 million combined spring and fall pig crop, 70 million hogs slaughtered, lard yield, 30 pounds per animal.

[2] Following assumptions made in developing estimates: cotton, 23 million acres harvested, yielding 11 million bales; soybeans, 220 million bushel crop, 177 million bushels crushed; flaxseed, acreage harvested increased to 5 million; lard, 75 million hogs slaughtered with 32 pounds of lard per animal, lard yield may reach 34 pounds per hog because of heavy slaughter; inedible tallow and grease, more grease less tallow than in 1946-47. Butter estimated at 13 lbs. per capita.

Sources: 1940-41—1945-46—Bureau of Census except lard and butter, U. S. Department of Agriculture 1946-47 and 1947-48 Estimates—Foodstuffs Division, U. S. Department of Commerce

Prepared by U. S. Dept. of Commerce

Naval Stores

THROUGHOUT THE war period, the naval stores industry operated under difficulties including lack of manpower, price controls, restrictions on industrial use, and establishment of quotas for foreign trade. As a result, production of rosin and turpentine dropped continuously in the war years. In the 1945-46 crop year that trend was reversed and a further substantial gain in output is anticipated in the current year.

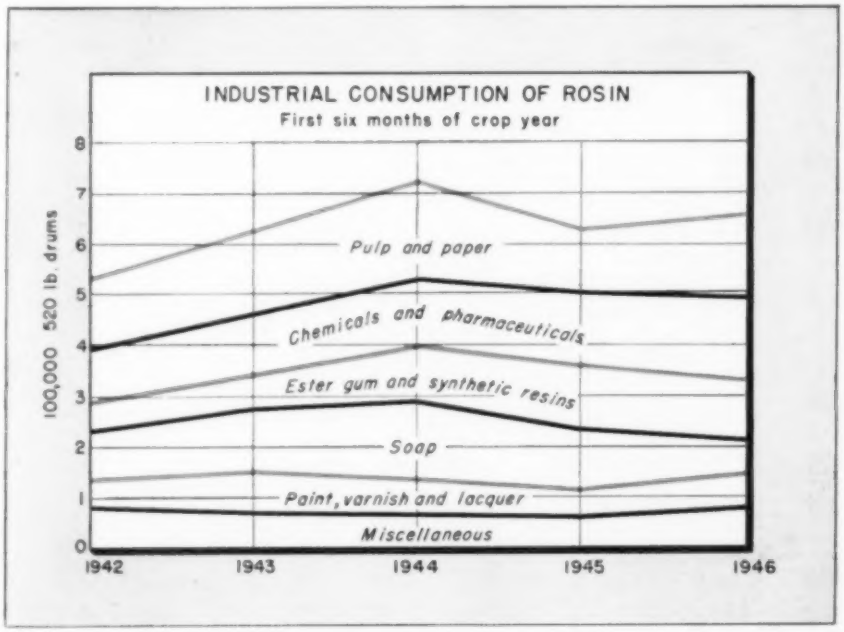
Latest available production data are those of the Bureau of Agriculture and Industrial Chemistry covering the first half of the 1946-47 crop year. The figures are encouraging inasmuch as they show a healthy increase over those for the comparable period of 1945. In the case of rosin, production in the six-month period is reported at better than 17 percent over the total for the preceding season and it is probable that it will cross 20 percent by the end of the crop year on March 31.

Following the usual seasonal trend it is expected that the second half of 1946-47 will record a drop in production of gum rosin as compared with the first half but the rate of decline may be lessened by the return of a free trading market and the prevailing price levels. However, forecasts for a rise in second half operations are based on the improved position of the wood branch of the industry where the overhauling of equipment and the installation of new productive capacities have speeded up monthly outputs so that a new high for that branch seems to be in the making.

Although prices for naval stores were controlled in the war period, they were not stationary and the flexibility of controls made possible a continuation of the rising price trend which started just before the war. The government bureau in its report on production included a price study which shows that the weighted average monthly price at Savannah for gum spirits of turpentine was 25.31c. a gal. for the 1939-40 crop year. An unbroken upward movement is reported for each succeeding year with the monthly average for 1945-46 reaching 86.41c. a gal. In the current season the upward surge was heightened by the demise of OPA and while buyer resistance brought some recession from the peaks, the monthly average for the 12-month period undoubtedly will be far above that of any of the preceding years.

Gum rosin followed pretty much the same price pattern as that reported for turpentine. In 1939-40 the monthly average at Savannah was $2.37 per 100 lb. It fell to $1.98 in the following year but from then on it began to climb steadily and reached $6.45 in 1945-46. Continuing along this line, the monthly average for the first half of the 1946-47 season was $6.87 and as the second half progressed the rate of price increase was lifted so it is evident that the average for the full 12 months will establish a new high.

Export trade in rosin in 1946, even under the restriction of quotas, more than doubled that for the preceding year but still was far below the prewar normal. Last month controls over exports were removed and this may clear the way for a material gain in the volume of business with outside countries. In fact some rather ambitious plans for expanding rosin production in the next few years are based on the probability that a large percentage of production will enter foreign trade.



Supply and Distribution of Turpentine and Rosin

	April-September, 1946			April-September, 1945		
	Total	Gum	Wood	Total	Gum	Wood
Turpentine, 50-Gal. Bbl.						
Carryover, April 1	100,749	58,088	42,661	202,546	168,011	34,535
Production	313,410	179,255	134,155	281,124	158,981	122,143
Imports	10,081	10,081	—	8,896	8,896	—
Available supply	424,240	247,424	176,816	492,566	335,888	156,678
Carryover, Sept. 30	90,167	48,411	41,756	165,326	123,460	41,866
Apparent consumption	334,073	199,013	135,060	327,240	212,428	114,812
Exports	45,288	32,216	13,072	51,146	42,032	9,114
U.S. consumption	288,785	166,797	121,988	276,094	170,396	105,698
Rosin, 520 lb. drums						
Carryover, April 1	388,682	237,504	151,178	388,266	265,881	122,385
Production	906,366	469,195	437,171	774,481	431,055	343,426
Imports	—	—	—	9,326	9,326	—
Available supply	1,295,048	706,699	588,349	1,172,073	706,262	465,811
Carryover Sept. 30	402,513	276,494	126,019	473,146	325,937	147,209
Apparent consumption	892,535	430,205	462,330	698,927	380,325	318,602
Exports	217,348	152,710	64,638	64,678	30,272	34,406
U.S. consumption	675,187	277,495	397,692	634,249	350,053	284,196

Foreign Trade in Chemicals

DURING THE war years, detailed information on our trade with outside countries was not publicly available but now figures for exports and imports are being published again and the accompanying tabulations offer a comparison of the outward and inward movement of chemicals in the last prewar year, from 1942 through 1945, and for the first nine months of 1946.

The vast change in our export business in the last seven years is shown very clearly in a comparison of dollar values. In 1939 exports of chemicals and related products carried a valuation of approximately $198 million which had almost doubled by 1942 and increased in the following years until it reached its high of $558 million in 1944. Estimated from three-quarter figures, the total for 1946 will

EXPORTS

EXPORTS OF CHEMICALS BY PRINCIPAL PRODUCTS

ARTICLE	Quantity in Thousands (Pounds Unless Otherwise Specified) 1939	1942	1943	1944 [1]	1945 [1]	Jan.-Sept. 1946 [1]	Value (Thousands of Dollars) 1939	1942	1943	1944 [1]	1945 [1]	Jan.-Sept. 1946 [1]
GRAND TOTAL, VALUE	.....	.....	.....	.....	.....	.....	$197,840	$388,133	$543,305	$558,279	$463,620	$423,388
Chemicals and Related Products (Group 8)	.....	.....	.....	.....	.....	.....	164,374	347,727	474,340	471,642	414,313	370,968
Coal-tar chemicals	.....	.....	.....	.....	.....	.....	14,484	30,976	30,544	36,337	35,164	44,904
Benzene (gal.)	12,004	187	44	567	2,945	5,468	1,787	57	17	196	510	1,001
Toluene	.....	74,598	81,601	114,773	39,875	15,996	.....	3,989	4,379	5,395	2,131	692
Phenol	2,058	19,109	30,839	28,723	16,852	20,824	281	2,521	4,211	3,423	1,984	2,214
Coal-tar dyes, stains, color lakes, etc.	13,716	15,962	17,711	19,562	22,076	33,042	6,432	12,729	13,338	16,038	19,538	25,740
Medicinal and Pharmaceutical Preparations	.....	.....	.....	.....	.....	.....	22,318	43,780	69,027	105,925	115,843	108,686
Vitamins, etc.	.....	2,577	4,668	7,371	9,547	7,479	830	9,708	21,016	29,484	29,079	20,212
Biologics, for human use	.....	.....	.....	.....	.....	.....	2,637	3,981	7,064	9,810	10,769	8,748
Druggists' nonproprietary preparations	.....	.....	.....	.....	.....	.....	6,039	6,811	5,099	8,147	9,122	5,239
Medicinal chemicals	.....	.....	.....	.....	.....	.....	1,654	9,260	14,891	33,392	36,756	51,776
Industrial Chemical Specialties	.....	.....	.....	.....	.....	.....	36,044	64,342	71,140	72,140	78,417	68,201
Agricultural insecticides	.....	.....	.....	.....	.....	.....	3,100	6,003	6,598	6,093	7,161	8,377
Household and industrial insecticides, disinfectants, etc.	8,912	5,306	10,518	17,284	25,887	23,929	1,873	932	1,752	3,628	11,340	6,022
Textile specialty compounds	10,426	9,136	8,115	9,579	11,129	12,444	792	1,310	1,220	1,637	2,054	2,547
Synthetic gums and resins	19,419	39,023	45,696	51,040	51,529	53,821	8,147	20,578	23,471	22,915	21,304	21,752
Tar acid resins, in powder, flake, or liquid form	.....	6,421	7,168	9,960	10,550	13,152	.....	1,158	1,478	1,864	1,989	2,560
Polymers of styrene, vinyl acetals, etc.	.....	4,846	10,404	8,837	8,531	6,195	.....	2,552	5,111	3,521	3,646	3,453
Cellulose nitrate	5,309	6,987	6,794	7,205	5,798	5,729	3,636	6,345	6,058	6,017	4,720	4,367
Cellulose acetate	2,213	6,624	5,202	6,818	6,974	6,792	2,133	5,462	4,058	5,164	4,975	4,655
Cementing preparations	4,669	2,401	2,428	6,225	8,186	6,495	607	456	416	1,210	1,544	1,447
Specialty cleaning and washing compounds	4,480	6,766	8,327	9,933	11,554	14,036	433	633	693	900	1,060	1,270
Polishes	7,424	6,621	8,363	12,182	13,110	13,563	1,392	1,296	1,669	2,660	2,998	3,428
Ethyl fluid	.....	3,560	3,709	2,451	2,698	.....	.....	14,385	15,108	10,239	10,676	.....
Industrial Chemicals	.....	.....	.....	.....	.....	.....	36,505	86,191	115,934	131,220	90,872	62,371
Acids and anhydrides	49,942	68,378	62,683	99,920	92,290	66,179	2,432	4,979	5,736	5,524	5,568	6,101
Acetic acid	1,794	725	634	962	1,832	4,857	141	115	89	139	251	612
Alcohols and glycols	.....	.....	.....	.....	.....	.....	4,092	28,032	51,398	64,833	31,514	5,613
Methanol (gal.)	1,220	3,764	1,628	2,218	1,832	355	473	1,773	750	609	542	180
Ethylene glycol	.....	63,020	71,426	40,156	23,580	11,705	.....	7,319	7,726	3,977	2,330	1,088
Butyl alcohol	7,618	14,083	15,519	15,848	6,041	3,991	593	913	2,736	3,214	1,221	578
Glycerine	7,399	32,638	24,573	9,118	7,598	451	959	5,641	4,411	1,672	1,598	103
Acetone	23,115	69,575	34,935	38,494	22,405	17,486	1,562	5,095	2,447	3,109	1,818	1,282
Synthetic collecting reagents	11,583	12,682	14,228	15,189	13,829	10,714	1,905	2,387	2,894	2,904	2,446	1,918
Butadiene	.....	.....	5,222	21,164	15,788	.....	.....	.....	940	4,348	3,817	.....
Aluminum sulphate	69,467	88,857	75,892	82,867	75,944	54,366	745	1,103	953	1,072	994	682
Bleaching powders	.....	2,414	6,049	5,081	5,799	22,119	.....	378	454	436	639	1,844
Calcium carbide	8,328	54,923	23,342	18,125	24,167	51,756	260	2,337	1,075	778	1,135	2,154
Potassium hydroxide	.....	6,907	19,628	13,379	16,726	13,403	.....	546	1,231	953	1,187	960
Sodium compounds, n.e.s.	705,563	490,095	809,349	566,611	506,489	379,294 [2]	14,777	14,807	18,336	14,827	13,146	[2] 12,425
Sodium borates	182,278	38,134	34,051	37,222	46,689	.....	3,230	1,072	1,023	1,067	1,310	.....
Soda ash	160,113	128,998	305,854	158,695	140,806	115,900	2,080	1,975	3,758	2,330	2,053	1,847
Caustic soda	261,000	164,358	327,290	242,748	184,004	93,212	5,535	4,871	7,712	6,107	4,505	2,490
Sodium phosphate	8,906	11,437	9,854	12,930	11,358	12,881	385	679	544	787	762	810
Gases compressed and liquefied	.....	.....	.....	.....	.....	.....	1,849	4,422	2,104	3,084	3,002	2,977
Gaseous refrigerants	7,839	4,655	6,199	12,085	14,977	15,422	1,262	910	826	1,504	1,889	1,991
Chlorine	12,001	7,882	10,655	25,609	8,340	7,548	257	168	232	489	232	233
Pigments, paints and varnishes	.....	.....	.....	.....	.....	.....	22,762	20,388	22,488	25,685	30,799	37,403
Mineral earth pigments	51,958	47,332	32,096	32,990	33,148	35,052	816	877	914	849	930	1,021
Chemical pigments	250,882	199,034	197,095	237,291	264,536	284,308	12,803	12,441	12,764	14,658	17,883	21,550
Carbon black or gas black	203,828	115,635	104,912	156,952	173,773	205,258	8,889	5,229	4,824	7,481	9,830	13,531
Titanium dioxide and pigments	8,638	17,740	19,530	21,850	25,648	24,246	698	1,707	1,830	1,851	2,316	2,307
Ready mixed paints (gal.)	2,607	1,933	2,214	2,359	2,888	3,642	4,707	3,793	4,504	4,950	5,994	7,720
Fertilizers and fertilizer materials (tons)	1,390	852	798	783	917	836	16,991	14,771	20,095	15,314	18,259	17,591
Nitrogenous fertilizer materials (tons)	165	67	93	36	111	136	4,747	3,461	6,446	2,084	5,592	6,409
Phosphate rock (tons)	949	529	358	439	494	455	5,233	3,348	2,875	3,469	3,783	3,802
Superphosphates (tons)	95	165	240	184	185	171	1,010	4,882	7,194	4,871	4,240	4,610
Potassic fertilizer materials (tons)	122	75	100	98	93	65	4,447	2,184	3,168	3,140	2,987	2,202
Explosives, Fuses and Blasting Caps	.....	.....	.....	.....	.....	.....	4,999	78,666	134,159	66,004	16,430	3,541
Dynamite	22,204	20,131	32,464	51,450	20,411	9,173	2,857	2,539	4,030	5,469	2,281	1,204
Trinitrotoluene	.....	96,128	226,617	185,126	35,520	.....	.....	15,125	42,760	25,291	3,258	.....
Soap and Toilet Preparations	.....	.....	.....	.....	.....	.....	10,271	8,613	10,953	19,017	28,529	28,271
Soaps	35,129	29,095	42,592	34,708	92,289	82,951	3,448	3,480	4,358	5,763	12,792	10,105
Toilet soap	13,041	5,193	7,560	13,696	35,678	22,218	1,675	1,113	1,505	3,070	6,742	3,968
Dentrifices	2,702	1,521	2,725	6,729	2,668	3,935	2,100	1,312	2,398	4,790	2,526	3,752
Toilet powders	.....	.....	.....	.....	.....	.....	1,118	678	756	1,329	2,277	2,620
Other Related Products	.....	.....	.....	.....	.....	.....	33,466	40,406	68,965	86,637	49,307	52,420
Naval stores, gums and resins	.....	.....	.....	.....	.....	.....	15,094	12,838	13,658	14,216	12,963	19,108
Rosin	302,980	198,003	235,556	128,761	77,447	157,387	8,967	6,522	9,041	6,375	4,505	10,940
Turpentine (gal.)	11,864	2,377	2,148	3,180	4,098	3,361	3,174	1,632	1,581	2,740	3,637	3,146
Drugs, herbs, leaves, and roots	5,196	2,590	2,069	3,478	3,700	5,763	1,564	905	920	1,458	2,219	3,781
Linseed oil	2,566	57,753	224,466	313,555	23,982	2,032	253	7,491	32,040	47,416	3,554	353
Essential oils and perfume-flavor oils	2,136	1,734	1,879	1,746	1,989	1,957	3,134	6,056	7,235	8,853	11,093	10,056
Peppermint oil	396	191	225	280	316	263	994	944	997	2,018	2,497	1,908
Vegetable dyeing and tanning extracts	41,617	23,857	22,829	20,257	18,548	18,846	1,748	1,262	1,206	1,252	1,200	1,871
Sulphur	.....	.....	.....	.....	.....	.....	11,682	11,854	13,906	13,442	18,278	17,251

[1] Preliminary. [2] Sodium borates not included in this total. NOTE: Blank spaces indicate either no data available, no separate export classification, or no exports.

Source: Compiled in the Chemical and Drug Division from data supplied by the Bureau of the Census and the Bureau of Foreign and Domestic Commerce, United States Department of Commerce.

and Allied Materials

surpass even that of the peak year.

A high level for exports of chemicals seems assured for some time to come. Many reasons contribute to the situation. Many countries outside the war zones have become much more highly industrialized and have increased their requirements for chemicals; countries in war areas are in need of large supplies of raw materials with which to rebuild their industries; and countries formerly very prominent no longer have export surpluses and their place must be taken by countries whose productive facilities are intact and capable of expansion.

Imports of chemicals also gained in volume in recent years but to a lesser extent. In both cases, increases in valuation was greater than that for tonnage because of higher prices.

IMPORTS

IMPORTS OF CHEMICALS BY PRINCIPAL PRODUCTS[1]

ARTICLE	Quantity in Thousands (Pounds Except as Otherwise Specified) 1939	1942	1943	1944[2]	1945[2]	Jan.-Sept. 1946[2]	Value (Thousands of Dollars) 1939	1942	1943	1944[2]	1945[2]	Jan.-Sept. 1946[2]
GRAND TOTAL, VALUE	.....	.....	.....	.....	.....	.....	$142,999	$169,037	$280,300	$257,964	$261,680	$204,562
Chemicals and Related Products (Group 8)	.....	.....	.....	.....	.....	.....	79,479	88,388	203,540	155,259	145,709	72,986
Coal-tar chemicals	.....	.....	.....	.....	.....	.....	18,942	5,881	9,003	11,432	11,716	4,367
Crudes	.....	.....	.....	.....	.....	.....	7,211	2,553	5,923	8,362	6,728	2,120
Creosote oil (gal.)	51,877	7,629	2,060	3,236	2,237	398	5,769	945	294	461	300	55
Benzene (gal.)	326	3,066	32,452	53,679	32,638	2,319	39	152	2,967	3,687	2,131	235
Intermediates	2,667	2,471	4,437	8,756	696	1,925	3,067	564	656	1,389	218	288
Coal-tar dyes, colors and stains	5,138	873	603	299	657	726	8,058	1,879	1,459	636	1,547	1,815
Explosives (except smokeless powders)	203	2,945	324	3,973	26,108	.....	46	818	85	858	3,181	...
Medicinal and Pharmaceutical Preparations	.....	.....	.....	.....	.....	.....	5,506	2,650	4,894	13,269	10,983	5,897
Caffein	.....	2	265	362	333	225	.....	14	2,579	3,457	2,549	1,365
Menthol, natural and synthetic	406	118	106	541	793	332	884	353	874	7,448	5,968	1,594
Industrial Chemicals	.....	.....	.....	.....	.....	.....	17,631	24,272	28,248	38,881	38,516	27,296
Acetic acid	1,439	11,283	10,455	6,576	15,125	4,627	60	694	584	362	870	244
Arsenious acid	29,348	32,700	32,225	22,107	28,496	21,851	562	893	877	570	713	601
Tartaric acid	116	5	2,012	4,174	2,999	28	24	2	1,097	2,527	1,872	18
Ethyl alcohol (gal.)	1	1,034	11,917	30,166	34,127	17,758	1	362	6,632	19,021	18,840	12,282
Camphor	2,503	15	.....	1	3	*	865	9	.....	.....	3	*
Glycerine	11,318	6,105	10,192	6,060	9,509	20,312	758	658	1,059	528	739	3,614
Potassium bitartrate, crude argols, etc.	17,370	8,103	638	10,123	19,609	13,303	1,217	1,702	106	1,417	2,874	1,818
Sodium compounds	.....	.....	.....	.....	.....	.....	5,258	3,723	2,917	3,329	3,986	2,882
Sodium cyanide	42,686	69,950	66,706	80,240	91,984	59,540	3,123	2,380	2,230	2,700	3,128	2,169
Pigments, paints and varnishes	.....	.....	.....	.....	.....	.....	1,519	572	282	1,128	1,054	942
Fertilizers and fertilizer materials (tons)	1,374[4]	1,186	1,301	1,383	1,607	1,008	32,455	25,917	32,920	35,454	41,327	28,431
Nitrogenous fertilizer materials (tons)	1,090	1,095	1,137	1,161	1,358	873	24,666	23,278	29,058	31,813	37,307	25,065
Ammonium sulphate (tons)	109	53	100	104	119	88	2,959	1,806	3,367	3,207	3,910	2,940
Calcium cyanamide (tons)	133	90	126	102	141	118	3,174	2,359	3,819	3,092	4,271	3,739
Sodium nitrate (tons)	604	899	761	712	850	472	11,213	17,183	15,189	15,305	18,559	9,948
Ammonium phosphate (tons)	35	28	44	92	93	74	1,628	1,150	1,827	3,942	3,993	3,295
Phosphatic fertilizer materials (tons)	24	23	55	140	161	50	442	406	452	1,030	1,145	457
Potassic fertilizer materials (tons)	212	16	45	14	7	8	5,752	418	1,287	398	231	257
Potassium chloride, crude (tons)	84	2	25	4	7	3	2,314	40	706	119	230	103
Explosives	.....	.....	.....	.....	.....	.....	17	998	381	493	8,301	104
Smokeless powder	.....	1,593	139	290	20,052	158	.....	771	56	138	8,063	73
Fireworks and Ammunition	.....	.....	.....	.....	.....	.....	393	26,644	126,198	52,780	29,402	279
Soap and Toilet Preparations	.....	.....	.....	.....	.....	.....	3,016	1,454	1,614	1,822	4,470	5,670
Soap	3,428	4,352	8,054	381	97	6,182	480	244	453	86	485	1,033
Perfume materials	.....	.....	.....	.....	.....	.....	1,983	998	643	1,348	3,031	3,668
Perfumery and toilet waters	.....	.....	.....	.....	.....	.....	396	187	302	246	706	935
Other Related Products	.....	.....	.....	.....	.....	.....	63,520	80,649	76,760	102,705	115,911	131,576
Bones, crude, ground, etc. (tons)	75	49	39	60	49	35	1,490	1,400	1,418	2,064	2,004	1,708
Glues and gelatins	.....	.....	.....	.....	.....	.....	207	108	62	142	118	362
Casein or lactarene	15,832	16,819	28,426	47,826	52,023	37,501	886	3,500	2,867	4,616	5,393	8,837
Beeswax, crude	4,667	5,282	4,409	4,220	7,365	5,347	904	2,090	1,576	1,595	2,761	2,395
Vegetable tallow and waxes	26,944	24,182	31,986	27,016	27,409	26,005	5,940	12,338	15,178	14,174	14,043	22,757
Gums, resins and balsams	.....	.....	.....	.....	.....	.....	14,338	21,140	21,006	30,541	27,152	33,634
Varnish gums and resins	93,330	65,235	23,468	38,219	38,275	48,198	5,695	10,014	4,881	10,963	8,301	13,012
Turpentine, tar and pitch	.....	.....	.....	.....	.....	.....	146	308	484	528	549	600
Chicle, crude	14,679	14,312	21,347	22,030	13,466	12,359	5,151	5,255	8,945	11,570	9,339	9,538
Gum arabic	9,290	12,833	7,009	8,105	16,813	14,694	635	1,197	661	708	1,389	1,429
Gum tragacanth	3,065	2,770	1,511	1,930	2,994	2,058	1,264	1,566	1,568	2,392	2,224	1,808
Crude drugs and botanicals	.....	.....	40,389	81,075	88,658	95,160	11,689	12,470	12,276	20,371	25,406	22,294
Pyrethrum or insect flowers	13,570	9,452	6,796	10,658	18,439	16,322	3,174	1,570	1,148	2,461	4,810	4,237
Opium, crude	181	343	299	300	454	321	708	1,794	1,616	2,492	4,478	2,768
Tung oil	78,718	8,269	68	1,770	560	16,890	11,724	1,914	23	568	145	5,600
Linseed oil	49	37,842	66,631	66,539	79,044	37,714	4	2,380	6,015	7,195	7,817	3,594
Essential or distilled oils	.....	.....	.....	.....	.....	.....	6,444	9,756	4,073	11,031	15,899	16,594
Dyeing and tanning materials	.....	.....	.....	.....	.....	.....	8,328	11,750	11,091	10,058	14,750	13,465
Sulphur	31,304	57,416	37,315	72	75	69	251	443	343	10	10	10
Pyrites (tons)	482	300	256	181	186	145	1,315	1,360	832	340	413	326

[1] Imports for consumption for the years 1939, 1942, 1943, and 1946. General imports in 1944 and 1945.

[2] Preliminary.

[3] Imports of camphor during the first nine months of 1946 totaled 393 pounds, valued at $318

[4] Imports of all fertilizers and fertilizer materials were reported in long tons in 1939.

NOTE: Blank spaces indicate either no data available, no separate import classifications, no imports, or imports of less than 500 pounds or dollars.

Source: Compiled in the Chemical and Drug Division from data supplied by the Bureau of the Census and the Bureau of Foreign and Domestic Commerce, United States Department of Commerce.

VALUE OF UNITED STATES EXPORTS OF CHEMICALS AND ALLIED PRODUCTS

by Groups, Areas, and Principal Countries of Destination, 1939, 1945 and (Jan.-Sept.) 1946

($1,000)

Area and Country	Coal-Tar Products			Medicinal and Pharmaceutical Preparations			Chemical Specialties			Industrial Chemicals		
			Jan.-Sept.			Jan.-Sept.			Jan.-Sept.			Jan.-Sept.
	1939	1945	1946	1939	1945	1946	1939	1945	1946	1939	1945	1946
North America:	4,568	10,003	8,097	7,199	30,302	23,892	11,480	36,649	32,670	12,830	27,457	19,103
Canada	3,630	6,798	5,441	2,575	6,882	6,546	8,036	20,073	19,956	7,898	17,142	11,796
Costa Rica	11	33	28	163	821	612	146	543	403	58	88	98
Cuba	150	458	366	1,595	6,483	6,473	633	2,352	2,182	1,104	2,135	1,597
Guatemala	12	86	104	168	765	717	362	986	790	36	159	129
Mexico	688	2,388	1,927	1,142	10,136	9,877	971	5,948	5,408	2,645	5,303	4,499
Neth. W. Indies	1	13	8	110	354	282	145	3,725	1,121	363	1,510	199
Panama, C. Z.	7	8	9	90	106	189	63	70	131	89	107	117
Panama, Rep. of	8	26	17	337	1,179	786	94	819	842	66	112	79
South America:	1,567	5,075	5,428	4,577	28,140	29,623	3,632	8,968	9,919	5,691	9,089	9,942
Argentina	593	882	1,662	906	4,504	4,834	1,128	1,210	2,175	1,733	1,091	2,244
Bolivia	8	113	101	57	560	709	29	90	116	88	147	215
Brazil	444	1,935	1,962	469	6,608	8,331	569	2,860	2,770	1,868	3,127	3,377
Chile	132	535	431	213	1,697	1,876	228	733	661	537	1,312	1,090
Colombia	207	628	675	1,195	6,499	5,850	431	1,323	1,419	701	1,334	1,125
Ecuador	35	89	71	110	923	766	43	149	165	105	176	141
Peru	68	282	170	297	1,764	2,118	595	720	838	327	636	709
Uruguay	41	355	168	88	957	618	76	489	466	48	391	280
Venezuela	38	237	182	1,172	4,196	4,201	503	1,198	1,429	273	756	693
Europe:	5,400	9,431	16,588	4,141	30,148	20,200	13,836	15,328	16,134	9,534	46,797	20,029
Belgium	1,454	198	2,107	62	338	1,225	382	315	809	695	399	1,703
Czechoslovakia	8	4	73	*	747	584	14	28	181	2	346	280
France	1,298	720	4,355	61	936	4,274	1,396	466	1,950	654	749	2,885
Germany	71	—	—	18	—	7	310	1	1	392	—	—
Greece	9	32	145	24	505	1,207	64	73	896	13	210	578
Italy	272	3	626	21	1,691	891	129	617	720	73	244	1,137
Netherlands	232	41	946	203	1,102	613	495	119	547	961	239	948
Norway	83	57	507	232	191	560	189	158	351	327	281	388
Poland	50	5	2	2	893	662	139	198	246	81	413	195
Portugal	47	228	442	98	545	732	42	167	435	78	447	524
Russia	10	4,247	115	1	12,332	980	14	2,637	60	162	34,628	184
Spain	82	626	1,086	73	468	715	26	73	94	176	257	357
Sweden	473	1,385	1,526	284	1,304	1,423	825	843	2,484	718	2,105	3,211
Switzerland	80	1,094	3,398	211	931	1,436	157	257	1,210	259	1,000	3,060
United Kingdom	1,247	745	1,030	2,719	6,801	2,618	9,092	9,140	4,897	4,702	5,192	3,896
Yugoslavia	*	2	31	4	936	594	67	181	204	19	122	121
Asia and Oceania:	2,868	9,714	14,012	5,737	19,326	26,197	5,756	14,580	6,582	7,740	4,717	11,089
Australia	103	188	134	444	879	407	1,286	1,747	823	1,399	907	848
British Malaya	39	—	20	277	*	56	156	4	44	185	15	87
China	1,036	745	5,325	670	724	10,137	309	203	2,780	548	84	6,413
Hong Kong	132	15	478	403	10	1,034	382	1	324	129	4	889
India	514	7,995	6,189	1,565	11,524	4,217	541	7,686	418	870	1,173	847
Japan	779	—	—	68	—	*	1,164	—	*	2,215	—	—
Netherland Indies	80	10	233	134	108	218	513	99	28	1,191	189	315
New Zealand	13	48	9	75	440	260	199	362	277	110	195	86
Philippine Is.	110	43	190	1,637	1,529	6,778	404	311	819	985	649	765
Turkey	9	404	902	19	1,164	640	111	156	332	29	571	342
Africa	82	941	779	664	7,927	4,274	1,340	2,892	2,896	710	2,813	2,208
Egypt	28	199	203	92	3,377	1,003	244	612	497	40	211	179
Union So. Africa	41	429	189	420	2,478	2,115	820	1,640	1,759	335	936	794
Total, All Countries	**14,484**	**35,164**	**44,904**	**22,318**	**115,843**	**108,686**	**36,044**	**78,417**	**69,201**	**36,505**	**90,873**	**62,371**

Area and Country	Pigments, Paints and Varnishes			Fertilizers and Fertilizer Materials			Explosives, Fuses, etc.			Soap and Toilet Preparations		
			Jan.-Sept.			Jan.-Sept.			Jan.-Sept.			Jan.-Sept.
	1939	1945	1946	1939	1945	1946	1939	1945	1946	1939	1945	1946
North America:	5,632	13,751	11,619	4,462	9,408	6,880	1,069	1,943	1,651	2,836	7,410	6,413
Canada	2,824	7,079	5,647	3,120	6,079	5,457	161	279	165	697	1,027	1,158
Costa Rica	117	288	193	15	90	80	39	37	35	67	322	233
Cuba	459	1,133	1,061	689	1,414	663	154	202	160	210	858	706
Guatemala	111	160	167	8	21	24	12	19	7	62	298	337
Mexico	820	2,618	2,667	318	266	200	317	871	885	200	1,097	611
Neth. W. Indies	262	366	390	2	1	4	8	18	6	178	625	547
Panama, C. Z.	245	354	241	1	2	2	71	47	83	271	380	702
Panama, Rep. of	151	632	326	9	27	14	14	40	17	265	864	552
South America:	3,277	6,321	6,742	426	1,105	663	1,462	2,544	1,298	1,313	4,066	3,781
Argentina	942	386	977	10	5	12	54	329	98	60	208	327
Bolivia	26	51	90	1	*	1	51	87	75	35	111	138
Brazil	656	1,891	1,829	88	665	420	28	263	4	178	886	713
Chile	200	565	485	141	26	59	201	234	284	26	98	74
Colombia	559	1,215	1,387	85	139	13	211	429	218	313	930	875
Ecuador	40	113	105	1	*	1	80	84	62	44	244	159
Peru	164	455	431	19	150	73	538	512	225	156	344	464
Uruguay	71	342	256	*	2	4	—	14	*	17	80	82
Venezuela	601	1,200	1,144	80	107	72	211	548	231	388	955	817
Europe:	8,835	6,482	11,770	6,395	6,869	8,083	4	11,595	264	1,479	9,546	6,377
Belgium	425	206	475	612	226	16	—	—	*	90	210	171
Czechoslovakia	12	*	102	67	457	233	—	—	—	3	1,119	978
France	1,396	598	2,924	156	1,273	2,390	—	—	157	116	77	474
Germany	865	—	*	1,970	—	—	—	—	—	2	268	96
Greece	18	*	120	172	216	232	—	1	22	10	921	186
Italy	394	17	418	575	237	1,484	—	—	65	16	2,837	1,142
Netherlands	419	12	362	604	1,562	1,439	—	—	*	337	31	2
Norway	315	120	357	337	—	4	—	—	—	159	4	80
Poland	113	36	25	19	306	995	—	—	—	—	1,760	1,360
Portugal	128	258	378	—	960	4	1	2	19	9	41	94
Russia	12	351	97	15	73	—	—	9,838	—	—	231	106
Spain	141	71	404	231	*	1	—	—	—	1	*	2
Sweden	755	530	1,222	924	206	495	*	—	1	367	75	263
Switzerland	81	123	316	8	1	*	—	—	—	74	60	237
United Kingdom	3,433	4,086	4,062	483	1,232	592	2	1,755	*	245	8	178
Yugoslavia	1	*	30	20	120	190	—	—	—	2	1,822	872
Asia and Oceania:	3,815	2,442	5,414	5,167	845	1,864	2,454	126	268	3,960	4,387	8,876
Australia	712	1,055	711	2	441	225	*	24	154	229	355	8
British Malaya	87	—	19	93	—	—	19	—	*	296	237	141
China	192	62	1,559	18	*	855	437	2	37	108	87	986
Hong Kong	56	—	200	4	—	128	5	—	23	132	11	673
India	489	509	701	62	45	17	6	24	—	950	1,152	666
Japan	332	—	—	3,097	—	—	—	—	—	30	—	—
Netherlands Indies	549	2	11	634	—	—	210	—	*	332	28	87
New Zealand	70	125	119	*	383	618	10	—	6	30	5	6
Philippine Is.	1,016	158	1,435	1,234	—	19	1,742	34	4	1,492	1,685	5,611
Turkey	58	52	251	*	—	—	—	—	—	10	3	—
Africa	1,202	1,803	1,856	541	32	121	10	222	60	683	3,140	2,824
Egypt	45	56	—	230	4	*	—	—	—	81	956	382
Union So. Africa	1,049	1,031	—	187	4	6	—	—	—	458	1,338	1,692
Total, All Countries	**22,762**	**30,799**	**37,403**	**16,991**	**18,259**	**17,591**	**4,999**	**16,430**	**3,541**	**10,271**	**28,529**	**28,271**

* Less than $500.

Source: Compiled in the Chemicals & Drugs Division from data supplied by the Bureau of the Census, U. S. Department of Commerce.

Rubber

1947 Showdown Year

J. V. HIGHTOWER

Washington Correspondent, *Chemical Engineering*

GOVERNMENT's $700,000,000-million-ton synthetic rubber business, which private industry hasn't shown signs of wanting to purchase under existing uncertainties, goes into 1947 for a show-down with natural rubber.

Most recent opinion is that world availability of natural rubber next year may reach 1,200,000 tons, a sharp rise over the 1946 figure of 850,000 tons. Government regulations controlling the consumption of synthetic are scheduled to expire March 31. Recent reductions in manufacturing costs of GR-S have made it competitive with natural rubber selling at the present price of 22.5c. Under most economic manufacturing conditions GR-S may soon sell, with a profit, at around 17c. However it would not be competitive, except for limited specialty uses, at that price if protective legislation were shelved and if natural rubber were to be sold again in New York, as it did in the last few years before the war, for 12 to 17c.

Consumer Acceptance

GR-S's big handicap is the fact that consumer acceptance of this rubber in tires is grudging and uncertain. The attitude might spell disaster for the GR-S market if all protective legislation were to be abandoned and if some advertisers began featuring 100 percent natural rubber in their products. Information is that some tire retailers are stressing the fact that their tires have much higher percentages of natural rubber than they had a year ago. The fact that for numerous purposes GR-S is fully equal or superior to the natural material is not too well known among consumers. Even less familiar is the fact that GR-S, when blended in proper proportions with natural rubber, produces passenger tires that are at least the equal of prewar all-natural tires.

It is GR-S, the product which amounted to 85 percent of total synthetic output in 1946, which is on the competitive hot-spot. The Inter-Agency Policy Committee on Rubber has said that "Both butyl and neoprene have already achieved a position competitive with natural rubber because of their special properties, and the Committee believes that this position is likely to be maintained for some time."

Costs

GR-S is today in a much better position, cents-wise, for its battle with natural rubber. The table shows out-of-pocket average manufacturing costs, which exclude amortization, profit, and Washington administrative expense. Data for 1946 are estimated on the basis of 1945 figures and other information.

Cost, Govt. Production, C. per Lb.

	1942-3	1944	1945	1945 Lowest	1946
GR-S	35.3	30.7	23.1	15.7	13.0
GR-M (neoprene)	28.9	23.9	22.3	19.0	9.0
GR-I (butyl)	71.2	26.8	16.3	13.0	12.7

In general, the out-of-pocket manufacturing costs have dropped from the early high levels as initial operating difficulties have been overcome and as production has climbed. In the case of GR-S the principal reason for reaching the 15.7-cent low point during 1945 was a sharp reduction in the average cost of butadiene.

Other reasons for lowered costs of GR-S center about improved yields in the plants producing butadiene and styrene, increases in the efficiency of utilization of butadiene and styrene in the copolymer plants and economies in the packaging and handling of the rubber. The downward trend of GR-S costs indicates that the rubber may be sold, profitably, at the range of 16 to 18c. per lb. The Office of Rubber Reserve has estimated that on the basis of butylene (raw material for butadiene) costing 10c. per gal. and styrene at a post-war cost of 5c. per lb., the out-of-pocket figure for GR-S may drop to as low as 10.7c. per lb. If to that figure is added an amortization, selling expense and profit item of 6c. (based on GR-S production at or near capacity) a total of 16.7c. is reached.

In February, 1946, the Inter-Agency Policy Committee on Rubber said that "assuming a reasonable amortization and fair profit, it is anticipated that the price of GR-S to the consumer may eventually be approximately 15-16c. per lb." Last summer one of the tire manufacturers estimated that GR-S could be made and sold by private industry at a 600,000 ton per year rate for between 15 and 17c.

How 17-cent GR-S compares in price with the gyrations of natural rubber may be seen from the accompanying table. The period covered includes the first world war, the short depression in the 20's the British Rubber Restriction Period of 1922-28, the 1929-33 depression and the International Rubber Regulation Period of 1934-41. The prices shown are averages. In the period in question "highs" reached the maximum figures of $1.13 in 1913, $1.02 in 1916 and $1.12 in 1925. On the basis of the prices in the table, the unweighted average for 1935-40 was 16.86c. per lb.

New York Wholesale Rubber Prices

Plantation Ribbed Smoked Sheets, C. per Lb. (Averages)

Year	Price	Year	Price
1913	82.0	1928	22.6
1914	65.3	1929	20.6
1915	65.7	1930	11.9
1916	72.5	1931	6.2
1917	72.2	1932	3.5
1918	60.2	1933	5.9
1919	48.5	1934	12.9
1920	35.9	1935	12.4
1921	16.5	1936	16.5
1922	17.3	1937	19.4
1923	30.7	1938	14.7
1924	26.4	1939	17.9
1925	73.0	1940	20.2
1926	48.7	1941	22.3
1927	38.1	1942	22.5

Rubber authorities are optimistic that through further research a general-purpose rubber, perhaps a modification of GR-S, equal to or better than the natural product for all uses will be developed. However, they consider that in the meantime the price of GR-S, now sold by the government at 18.5c., must remain several cents below the price of natural rubber, now 22.5c. if high-volume usage is to remain. Assuming that GR-S were sold, at a profit, at 17.0c., it would still be crowded to the ropes by natural rubber, if freely competitive conditions were allowed to prevail, when and if the natural commodity should again enter the country at the average price of the last five prewar years—16.86c. per lb.

Most rubber officials and rubber manufacturers consider that legislation to succeed the expiring wartime controls is essential, though views as to means required differ considerably. Plans for legislation are being whipped into shape in Washington for submission to Congress early in 1947.

DEATH By the Granulator

CROSBY FIELD

Colonel, Ordnance Department Reserves, U.S.A.

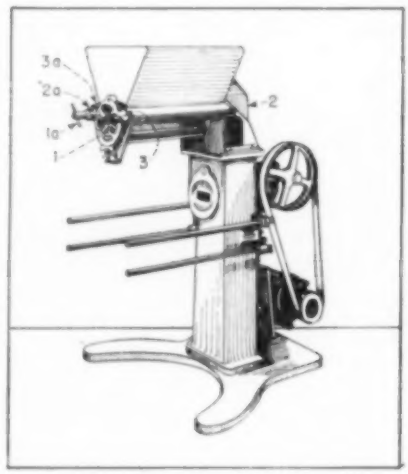
STUDY OF THE MISSILES RESULTING FROM ACCIDENTAL EXPLOSIONS YIELDS MUCH INFORMATION AS TO THEIR CAUSES

THIS INVESTIGATION started just after midnight, and was completed before sundown. It had its share of misinforming eyewitnesses, its peculiarly hidden missiles, and many conflicting and rationalizing personalities. Although the amount of explosive material was relatively small, nearly a score of persons were killed and three times that number injured.

The product had been manufactured in one part of the plant for a considerable period, but the increasing war demand necessitated use of additional space. Another part of the plant was converted to its production, and this unit had been in operation on a two-shift basis for only two days, when the explosion occurred. The unit consisted of several small buildings constructed of wooden frame with metal, wood or plasterboard sheathing and metal roofs, and separated from each other.

Building No. 1 was divided into three rooms by two wooden partitions extending from east to west (right to left). The northern room was used as a weighing room, the southern as a dry room and the middle for raw material storage. The building was of wood construction and had sprinklers. Access to the dry room was obtained from an outside door on the east wall (right). Raw materials stored in this building were strontium nitrate in drums, magnesium powder in metal containers, shellac in containers, and a small amount of beeswax.

A batch of a standard weight, less than 15 lb. total, was made by screening, weighing and hand blending the strontium nitrate and shellac in specified proportions in Building No. 1. It



The last batch had been placed in granulator when explosion occurred

was carried by hand in galvanized iron pails to Building No. 2. In the former beeswax and carbon tetrachloride also were mixed and carried to Building No. 2. In No. 2 the nitrate and shellac mixture was placed in a steam jacketed mixing machine and the carbon tetrachloride and beeswax were poured on top.

Powdered magnesium was screened and weighed in Building No. 1 and then carried in a conductive rubber container holding the correct weight to No. 2 where it was poured into the mixing machine while it was running. This machine was a miniature of a standard dough mixer having two sigma blade agitators. After this mix had been finished it was carried 65 ft. to the small shed No. 3 for an operation known as granulation.

Granulator

This operation was performed in a machine shown in an accompanying diagram. The operating part of this machine was a 12-mesh bronze screen through which this mix was forced by means of an aluminum rotor having phenol (Texolite) plastic blades. These blades were held in six aluminum arms and the feed hopper and other parts exposed to the mixture were aluminum. The screen was held in position by having its width just

The first of several cases of how Colonel Field and his organization solved the baffling investigations of the causes of accidental explosions during the recent World War appeared in the January issue of Chemical Engineering. *A second in the series appears here. These engineers found that when discrepancies arise between stories of eyewitnesses and conclusions forced by a complete missile study, the latter will usually prove to be the more reliable.*

equal to the length of the hopper and the ends being inserted in slots in shafts 2 and 2a. By means of the pins 1 and 1a and the pawl and ratchet 3 and 3a in these shafts the screen was rolled up on both shafts until it became taut against the blades. The rotor was given an oscillatory motion, that is, the blades rotated one complete revolution in one direction and then reversed. This motion was obtained by means of a pinion and segmental gear operated by an arm connected to a crank shaft driven by a motor through a reducing gear and belt. Trays were placed on the rods serving as arms and these trays were taken individually to the dry room in the south end of Building No. 1.

The day shift was due to be relieved within the hour. The last batch had been placed in the mixer when the explosion occurred. After the explosion the grounds looked as shown in the picture. Buildings No. 1, 2, 3, 4, 5, 6 and 7 were destroyed. The wind was blowing from the northwest and it is interesting to note that all buildings to the north that were destroyed were damaged only by blast pressure and all buildings to the south by both blast pressure and fire.

This explosion was comparatively easy to investigate because it was obvious at first glance that the initial explosion was either in the dry room of Building No. 1 or the granulator in No. 3. Numerous eye-witnesses saw or heard two explosions, and the nature of the materials and the appearance of the grounds both indicated that there were at least two explosions. Contrary to first impressions these did not originate in No. 1, although most of the damage done was because of the larger quantitiy of explosives in this building.

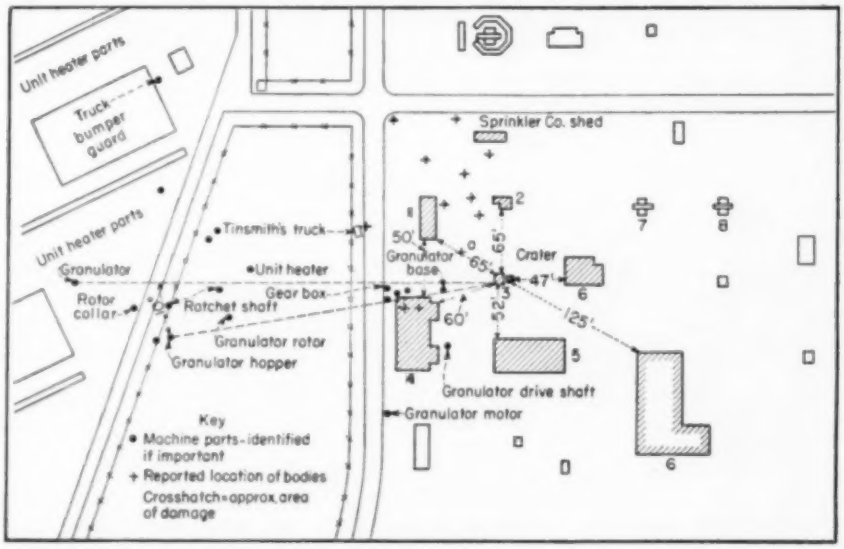
Fortunately all steam piping to the granulating building, No. 3, was of a much smaller size than the steam piping to the dry building, No. 1, and large sections of piping were tossed about by the explosion. In each case the piping leading to No. 3 lay underneath the piping originally going to No. 1, therefore the explosion must have occurred in No. 3 prior to No. 1.

Pipe as Evidence

Note that the finding of a few pieces of pipe would not have been sufficient evidence. When, however, a relatively large number of substantial lengths of pipe were mated in this fashion the evidence may be considered conclusive.

One of the most intelligent witnesses saw the explosion from his car,

Screen shaft from granulator was found in a tile pipe in a pile shown in the foreground. Other shaft was picked up alongside of nearby trailer



Detailed missile map of principal machine parts in Building Nos. 1 and 3

and was convinced that Building No. 1 exploded first. It was not until we placed him in his car at the spot he said he was and headed in the direction he had been going that he realized he had seen the explosion in his rear view mirror, and had failed to appreciate the left-right inversion in that view.

A detailed missile map of the principal machine parts in both Buildings 1 and 3 was made. The concrete foundation of the granulator remained substantially intact. A 7 ft. x 7 ft. crater about 19 in. at its deepest portion was found directly east of this foundation. The granulator had been held to its foundation by four bolts which had been sheared off in such fashion as to demonstrate that the granulator had left its base in a motion directly away from the crater and with its eastern side raised slightly. The two east bolts were sheared off directly. The west bolts had bent to the west before shearing, thus showing a slight tilt around the west edge of the foot of the granulator.

Having determined that the granulator explosion occurred first the problem of determining the location of its initiation and its cause was solved by studying the missiles. It will be noted that the granulator hopper, granulator rotor gear box and similar large pieces, traveled almost in a straight line. The survey was made with only a pocket type surveying compass, and lineal distances obtained in most cases by pacing. It was noted that all these parts lay within two radii with the crater as center and separated from each other by an angle of about 10 deg.

Study of the granulator hopper and

its rotor failed to produce any indication of burning. The bronze screen could not be found. Screen shafts evaded search for a considerable time but the first was found by investigating the interior of a tile pipe in a pile shown in the foreground of the picture. This tile pipe was chipped on its eastern edge and inside the pipe was found one of these shafts. The other shaft was picked up alongside of the trailer nearby.

The shaft found within the pipe had decided markings of flash burning on it near the ratchet and on the ratchet itself. The second shaft showed these same markings but to a lesser degree.

Little in Granulator

It was obvious therefore that the explosion had occurred when there was very little material left in the granulator otherwise there would have been flash or burn markings on the hopper and other parts as well as on the shaft. It is also obvious that this flash communicated itself outside of the granulator proper.

What could have caused the material to flash at this end of the rotor? Examination of the recovered parts of this granulator, and the disassembly of an identical machine and careful consideration of its parts and subassemblies, disclosed rubbing surfaces between which the explosive powder could penetrate.

This penetration could have been increased by any forcing of the material through the screen by additional pressure near the ratchet end of the hopper. Was there such additional pressure and how was it applied?

The body of the operator was found in the location indicated by the cross marked a on the missile map. She had been propelled from her original location with sufficient force to split open her skull against a steam pipe pole support and scatter her brain. She carried with her a sheet rock "cleaning paddle" used not only for cleaning but also sometimes for forcing the last of the mix through the screen. This paddle was found on the ground near her hand.

Because of this high velocity the horizontal projection of her path of flight very closely approximates a straight line. Drawing this in its proper vector relation to the horizontal projection of the trajectories of the granulator parts and the center of the crater shows that at the moment of the explosion she was standing right over the end of the rotor, with her paddle in hand, probably forcing the mix through the screen. There was ample incentive; she was finishing the next to the last batch for her shift; the last batch had already been placed in the mixer in Building No. 2 and would arrive at her granulator within the next few minutes; she could hear the employees in Building No. 1 cleaning up and preparing to leave.

Whether or not she was actually forcing the material is not of great importance, it only makes the ensuing flash more certain, and the burn markings show that such a flash did occur.

But how could so small a flash cause such great damage? Unaccompanied by a most unfortunate set of circumstances it couldn't; at its worst the burning of a pound or two of mix in the tray just under the hopper and the severe (possibly fatal) burning of the operator, was all that could have been expected.

Further investigation of the premises and interrogation of surviving employees disclosed the following facts: Production was being crowded, and about three times the normal weight of granulated mix was being placed in the trays under the granulator screen. This overloading slowed down the next step of the process, the dry room in Building No. 1. Some four or five hours previously the man whose job it was to carry the trays one by one from the granulator room to the dry room found no space left in the racks in the dry room. He stopped his work, and disappeared into the cafeteria (Building No. 4) where he was later killed.

Unexpected Spot

No one in authority stopped the flow of material or took other remedial action. The granulator operator had to put her finished trays somewhere, or stop work. She found a most unexpected spot.

A small room or closet had been added to the east wall of the granulator room by a lean-to type of wooden construction. In this was to have been placed air-conditioning equipment. Considerable piping already had been installed, but worst of all a 2 ft. sq. hole had been cut in the granulator room wall for a flue and this opening was approximately at the level of the trays on their rods under the granulator screen, and a short distance away. Into this closet she piled her trays until she had at least 125 lb. of mix in one pile, and possibly twice that amount. We know however from the size of the crater left by the exploding pile and the damage to adjoining buildings that the amount which exploded was somewhat more than 125 lb.

The course of the explosion is now plain. Starting with a friction produced flash in a small amount of explosive in the granulator screen, it ignited one or more trays of the mix under the screen; this communicated through the hole in the wall to the pile of trays in the adjoining closet; this exploded, hurling the granulator parts and other missiles about. Some of these hot high velocity fragments penetrated the walls of the dry room and ignited the contents of some of the trays on their racks. Some of this, (probably the wet material) ignited and burnt. After some five or ten seconds more had elapsed, the burning material exploded in a mass. This second explosion showered killing missiles all about, and also flaming embers into the blast shattered cafeteria building, No. 4, and the work buildings No. 5 and 6, and others to the lee. These buildings, with their blast trapped and injured personnel, took fire.

Corpses

Although the physicians examining the corpses stated that in certain cases death was due to fire, which was probably true from a strictly medical viewpoint, yet all bodies thus certified as dying from fire, when further examined, showed mortal injuries received prior to the fire. These injuries were all of one or two classes,—(a) the person had been hurled against some solid object with resulting smashing of the skull or other mortal injury or (b) high velocity fragments had penetrated the body. In both cases the deaths were due to movement of solid bodies and not due in any way to the direct effects of concussion on a human body.

Most of the death-dealing missiles appeared to be small sections of pipe and fittings.

Weather data were obtained from the meteorological officer of an air base nearby. These indicated that the temperature at the location of the explosion at the time thereof was probably 59 deg. F., the wind was in the neighborhood of 20 m.p.h. and the dewpoint of the air was 33 to 34 deg. (relative humidity 10 percent).

Many other interesting studies were made of this explosion which eventuated in recommendations for better procedure. The cause may be stated to have been local overheating of a thin film of the mix being granulated at the forward end of the granulator rotor due to extreme pressure at some point between the moving rotor and its stationary guide or its screen. This local overpressure may have been increased by manual pressure applied by the operator by means of a rock sheet paddle.

Plastic Fabrics

E. C. FETTER

Assistant Editor, *Chemical Engineering*

FILTER CLOTH, strainers, trays, conveyor belts and other industrial fabrics are now being made in commercial quantities from Saran, Dow Chemical Co.'s thermoplastic vinyl- and vinylidene chloride copolymer. In the form of pipe, fittings and tubing Saran gained wide acceptance during the past four or five years on the strength of its chemical resistance to almost all acids, alkalis, and solvents —the main exceptions being ammonium hydroxide and oxygen-bearing solvents like dioxane and cyclohexanone. (See "Properties and Applications of Saran Pipe," *Chem. & Met.*, Nov. 1945) Resistance of the fabrics is every bit as good as the pipe.

Saran fabric is available in all the familiar weaves—and many special ones—from open screen cloth to tight satins, twills, and herringbones. Considering the short time it has been on the market, the number and diversity of applications is surprising. Some of them are: Filter cloth in cider presses, reinforcing for the felt belt of a paper machine and for the paper liners of shipping containers, drying trays and bags in the cheese industry, storage battery separators, coverings for blowers in corrosive atmospheres, and a conveyor belt (which also acts as a filter) in a phosphoric acid plant. One of the new fabric's biggest advantages, of course, is its chemical resistance. As plating tank netting (see cut) it shows no sign of deterioration after a full year, where cotton netting lasted only three or four weeks. Longer life is also reported for Saran filter cloths being used with filter aid on rotary vacuum filters handling ligneous liquor in the paper industry. Chemical resistance is also important in yet another application, conveyor belts in a photo developing plant, but this one is more interesting in focusing attention on a second of the fabrics chief attributes, the ease with which it can be cleaned. Being woven entirely of monofilaments, it doesn't "soak up" liquids and can be cleaned completely and easily with a simple water rinse or even an air jet. For this reason it has been widely adopted for conveyor belts and trays in processes where carry-over must be prevented—like the photo developing plant just mentioned—or where it is important that there be no swapping of odors, colors, or tastes from one batch to the next, as in the case of the soap drying trays in the illustration.

To wind up the credit side of the ledger, the filaments have reasonably good tensile strength, about 47,000 p.s.i. at room temperature, and monofilaments (it's another story with multifilaments) have excellent abrasion resistance.

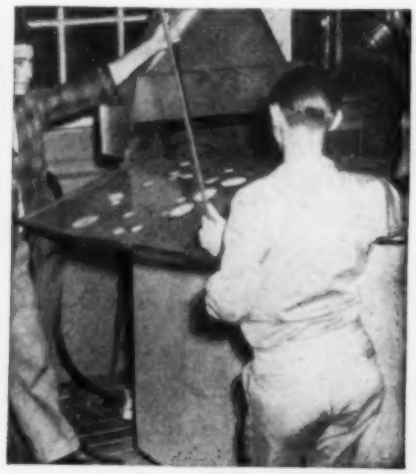
Now on the debit side, the biggest headaches stem from the fact that the material is thermoplastic and a monofilament. Saran doesn't soften and get tacky until 240-280 deg. F., but at 200 deg. F. the monofilament retains only about 70 percent of its room-temperature tensile strength, and above 150 deg. F. it shows a tendency to shrink. Shrinkage, incidentally, is a consequence of the way the filament is made. After being hot extruded at twice its finish diameter, it is immediately cooled to an amorphous state, then drawn out about four-to-one. Cold drawing causes crystallization and at the same time orients the crystals longitudinally, which gives the filament elasticity and high tensile strength, but also makes it subject to 12 to 15 percent shrinkage.

The disadvantage of being a monofilament shows up in cloths for filtration of very small particles. In the first place, the filaments are elastic and cannot be packed on the loom as tightly as a multifilament natural yarn. And secondly, the process fluid can only pass *between* the filaments, not *through* them as it can through a natural yarn. The upshot is that the removal of very fine particles and the maintenance of high flow rates cannot be achieved simultaneously, although either is possible if the other is not required. Multifilament Saran yarn, which would eliminate this shortcoming, can be produced but its abrasion resistance is not yet good enough for filter cloth. Research is in progress and it is hoped that abrasion resistant multifilament Saran will be on the market in a year or two.

At present, the largest weaver of Saran fabric is the Chicopee Manufacturing Co., which got started in the business late in 1940. Throughout the war all monofilament Saran cloth, of which Chicopee supplied by far the largest portion, was drafted for insect screening in tropical areas, where it outlived bronze screening several times over. Come reconversion, the company switched to domestic window screens, launched a colorful line of decorative fabrics, and finally in November, 1945, began pushing industrial applications. Its mill at Cornelia, Ga., completed early in 1946, is the first in the country to be designed and built exclusively for weaving plastics. Except for experimental runs with other plastics, the mill is devoted entirely to weaving a variety of monofilament Saran fabrics, all of which are marketed under the name "Lumite."

Filament diameters for Lumite range from 21 to 8 mils, widths up to 74 in., and cost from $2.75 to $4.70 per sq.yd., depending on weight of the material and filament diameter. The tightest cloth now being woven uses 8-mil filament and has 120 warp ends and 56 picks per inch. Closer weaves may soon be possible using 5-mil filaments, which are now being woven experimentally.

Saran screen cloth, framed, makes drying trays for soap (left), catches small objects that drop from plating racks in electroplating tanks (right)



Commercial Production of ENZYMES

J. A. SHELLENBERGER

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Kansas State College, Manhattan, Kan.

MANUFACTURING PROCESSES OF A SMALL BUT SIGNIFICANT SEGMENT OF THE CHEMICAL INDUSTRY ARE GENERALLY OUTLINED

Enzyme production is a little known and highly specialized branch of the chemical industry. Employed in fermentation processes and in leather tanning for centuries, enzymes, in more recent years, have gained commercial significance in a variety of other processes including tenderizing of meat, desizing of cloth, converting starches for sizing of paper and textiles, and in the preparation of corn sirups and fruit extracts. Produced by the life process of living cells, enzymes are unstable complex organic compounds which have the ability to bring about various chemical reactions.

With the exception of those extracted from animal glands, enzymes are obtained commercially from fungal and bacterial growth. Specific processes are required for the manufacture of different enzymes but the flow diagrams shown represent typical commercial methods. Most important of the process variables is temperature and enzymes are easily inactivated when subjected to adverse conditions. Of major importance, too, is the maintenance of aseptic conditions in the incubating chamber to prevent contamination. Many difficulties are involved in preparing and distributing large quantities of sterile medium and of inoculating the medium under aseptic conditions with the desired type of microorganism. Careful process control is essential to successful manufacture of enzyme products.

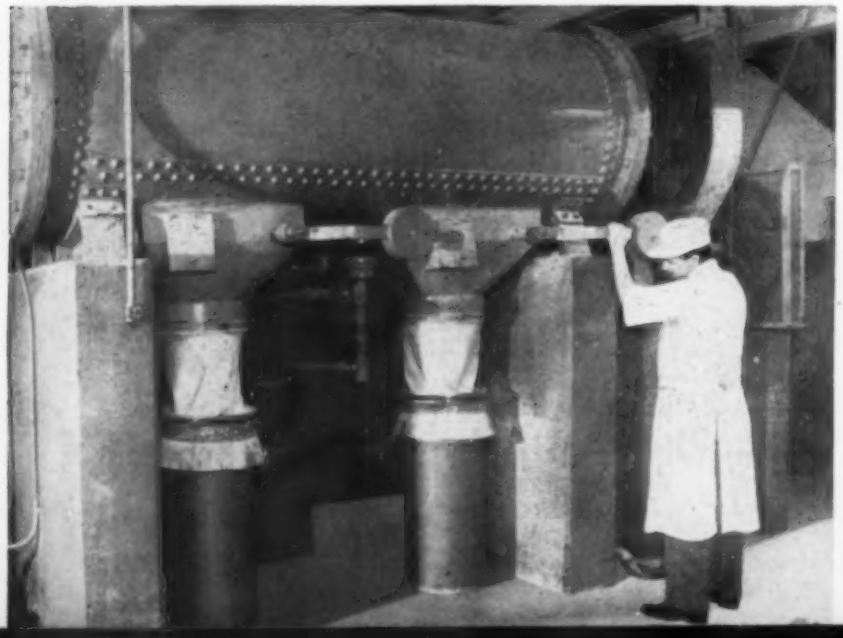
Fungal Enzymes

Although a variety of carbohydrate raw materials can be used as media for the growth of fungi, wheat bran has been used most extensively. The bran is first cooked for about an hour by direct steam under pressure to gelatinize the starch and sterilize the mash.

After cooling to about 40 deg. C., the media is prepared for transfer to the growing chambers by adjusting the pH, by adding mineral salts and inoculating with the desired mold culture. Although the pH range is not critical, it should be on the acid side. Addition of lactic acid can be used to bring the pH of the mixture to an approximate value of 6. It isn't always necessary to add mineral salts to the medium such as in the production of amylase using wheat bran. If inorganic salts are required, potassium phosphate, magnesium sulphate, sodium nitrate and ferrous sulphate will usually produce the desirable growth conditions.

Optimum growth conditions are controlled by regulating the temperature of the chambers. It is usually necessary to warm the moldy bran layer at the beginning and to cool when growth becomes rapid. Temperature for the first 24 hr. may be maintained at 32 deg. C., but when the cake begins to heat as a result of active growth, the temperature of the growing compartment is reduced to about 26 deg. C. After four days the mold mycelium will have matted the medium together and enzyme production will have reached a maximum.

Moist culture, on removal from the



Left—Enzyme materials are dried in this vacuum dryer before pulverizing

Below—High speed grinder for pulverizing dried enzyme prior to blending

growing chambers, is dried in either rotary or tray dryers. Highest temperature of the material should not exceed 100 deg. C. because, if subjected to higher temperature, the enzymes would be inactivated. Initial temperature depends on moisture content of the culture, type of dryer and size of charge. After drying, the material is broken up by grinding and may be marketed as is or processed further.

For the production of concentrated and standardized enzyme, the dried mold bran is extracted with water, filtered, and the enzyme precipitated from the filtrate by successive additions of ethyl alcohol. The precipitate is then separated from the liquor in centrifuges, dried in a vacuum dryer, and blended to obtain a final product of uniform activity. Here too, drying temperatures must be carefully controlled and should not exceed 55 deg. C. Typical enzyme preparations that can be manufactured by the above or similar methods include amylase, protease, protopectinase and pectinase.

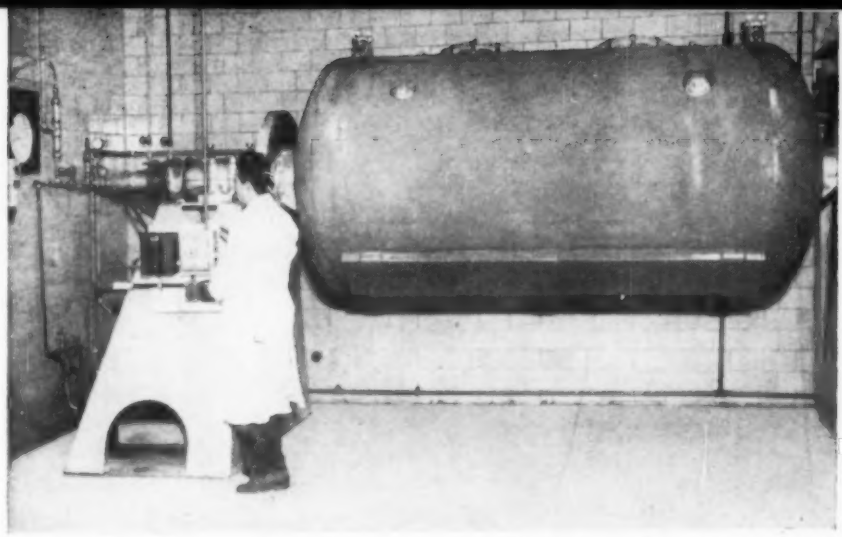
Bacterial Enzymes

Commercial production of enzymes by the action of bacteria on nutrient medium is a more difficult process to control than when molds are employed for the same purposes. It is more difficult to avoid contamination in the bacterial process and a more complicated plant layout is required.

Soybean meal is a common raw material for bacterial medium if amylases are to be manufactured. A slurry of water and soy meal is sterilized, cooked for about 3 hr. at 15 lb. per sq.in. steam pressure, and predigested by the addition of proteolytic enzymes. After this treatment the medium may be filtered. The pH of the predigested medium is adjusted to a value of about 5.5, nutrient salts added if necessary, and the solution sterilized for 2 hr. under pressure. When cooled the medium is inoculated under aseptic conditions, with the desired pure bacterial culture and the solution delivered to the growing chamber.

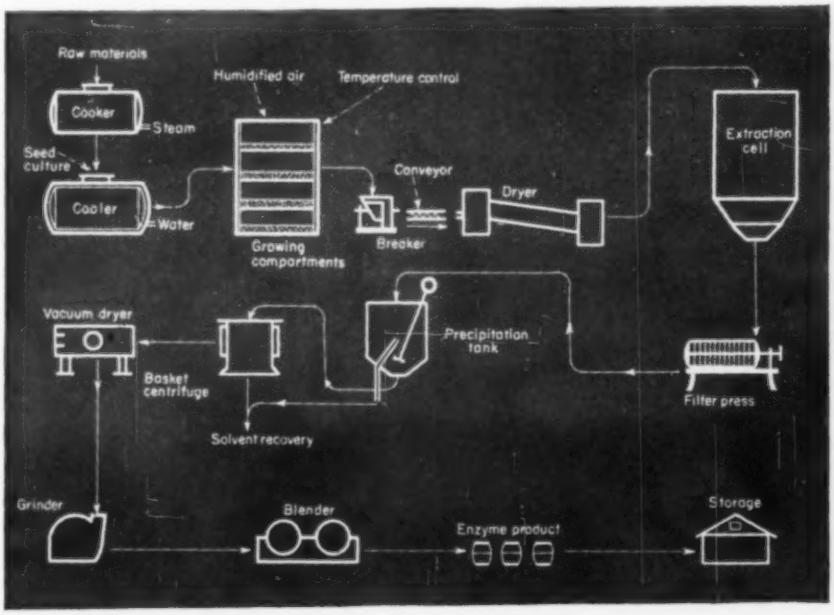
Maximum enzyme development occurs when the medium is placed in shallow containers and the oxygen-carbon dioxide tension carefully regulated during the growing period. After a firm pellicle has formed over the medium, production will have reached its limit and the solution can then be centrifuged from the shallow trays.

After the solution is passed through the filter press it may be marketed in liquid form or a precipitated concentrate may be prepared by the same processes as previously described for fungal enzymes.

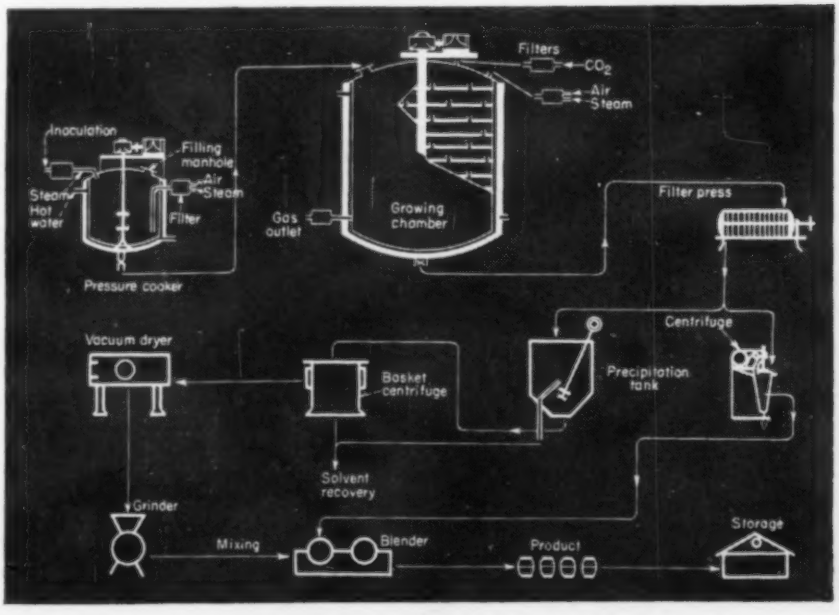


Cooker for preparing material for propagation of enzyme growths

Generalized flowsheet for production of fungal enzyme materials



Generalized flowsheet for production of bacterial enzyme materials



GRAPHITE HEAT EXCHANGERS

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GENERAL PRINCIPLES OF DESIGN AND SPECIFIC EXAMPLES OF PERFORMANCE. THE SECOND OF TWO ARTICLES ABOUT IMPERVIOUS GRAPHITE

HEAT EXCHANGERS using impervious graphite can be manufactured to practically any size required, but in cases where graphite tube sheets are employed the amount of surface area is limited to about 600 sq. ft.—this because the maximum diameter of graphite tube sheets is 29 in. When 600 sq. ft. must be exceeded, the surface should be split into two or more units or a different tube sheet material chosen. In cases where other tube sheet materials will withstand the corrosive condition but are not suitable from the heat transfer standpoint, it is possible to employ packed joints rather than cemented joints, using Neoprene gasketing material or synthetic rubber between the tubes and tube sheets. By this arrangement shell diameters can be carried to almost any size.

Floating Head Construction

Since graphite has one of the lowest coefficients of thermal expansion of any known material (about one quarter that of cast iron), it is necessary to employ a floating head design when cemented tubes are used in combination with metal shells. One tube sheet is clamped to the shell in fixed position, with latitude of movement allowed at the opposite tube sheet. Typical methods of construction are shown in Figs. 1 to 3. These drawings illustrate principles of construction rather than exact details of design, however.

Fig. 1 shows the floating head enclosed in a metal cover with packing around the nozzle. This principle of construction is extensively used, especially where pressure is relatively high on the shell side.

Fig. 2 shows a double packed joint on the periphery of the floating tube sheet, retained by the fixed dome. Separation of the two packed joints by a lantern ring prevents interleakage of the two fluids. Impervious graphite shell and two-pass flow are shown in this drawing, but the principle of construction is also applicable to metal shells and to single-pass or multi-pass flow, side nozzle in dome, and other modifications. This construction and that shown in Fig. 1 may be preferred where steam is used in the shell.

Fig. 3 illustrates the use of a flexible diaphragm between the shell and the floating head to seal the fluid in the shell and allow for the difference in expansion between the shell and the tube bundle. This construction is often used for condensers, absorbers, and low shell-side pressure applications. It is well adapted to the use of side nozzles on the floating head.

Multi-pass tube flow is readily accomplished by the use of machined impervious graphite domes; and shell side baffling presents no special problem, since all the conventional types of baffling have been used successfully in this equipment.

For the most economical tube layout, a 60 deg. triangular pitch is employed. The minimum distance between outside diameter of tubes (web) is $\frac{1}{4}$ in.

Bundle Sizes

An estimate of the number of tubes in a given tube circle diameter, usually accurate within ±5 percent can be obtained from the following formula:

$$\text{Number of tubes} = 0.91 \times \left(\frac{\text{Dia. of tube circle} - \text{O.D. of tubes}}{\text{Triangular pitch}}\right)^2$$

Tubes of $\frac{1}{2}$-in. and $\frac{3}{4}$-in. I.D. are available in 6-ft. lengths and other sizes in 9-ft. lengths. The maximum length between the inside faces of the tube sheets is 5 ft. $8\frac{1}{4}$ in. for the 6 ft. tubes and 8 ft. $8\frac{1}{4}$ in. for 9-ft. tubes. Where design conditions permit, it is

The first of this pair of articles appeared in January and reviewed the physical, thermal, and corrosion resistant properties of impervious graphite. Now we are interested in seeing how the material works out in the actual design and operation of heat exchangers. We find that through special fabrication techniques, some of which are cited, graphite has been adapted to a wide variety of constructions. Operating data from twelve installations are given as examples of efficiency.

most economical to use tubes of maximum length.

Babies are Standard

While larger tube bundles having up to 650 sq. ft. of external surface area are built to specification by heat exchange fabricators, there have been developed standard design seven-tube exchangers in three smaller sizes for pilot plants, pharmaceutical manufacture, or for all types of plating, pickling or heating processes to which external heat exchangers of smaller unit surface area are adaptable.

These standard exchangers have seven 1-in. I.D. × 1¼-in. O.D. tubes inside a standard weight 6-in. steel pipe of 36, 72, or 108-in. lengths, and will carry a working pressure of 50 p.s.i. on both the tube and shell sides. Water, brine or steam are suitable on the shell side. The units can be employed interchangeably as heaters, coolers, boilers or condensers and operated either vertically (supported from the flange at the fixed end) or horizontally (supported by a saddle or other device). They have found wide use as heaters and coolers for nickel plating solutions, as heaters and coolers for the chlorination of alcohol in DDT manufacture and as a reflux condenser on the vessel itself.

A unique feature of their construction is the combination of the tube sheet, dome and nozzle into one monolithic piece, which eliminates packed joints for the corrosive liquid and reduces the number of gasketed joints on the fluid side to one gasket at each nozzle. Floating head construction is employed with the stuffing box at the floating head end.

Impervious graphite articles can be used freely in combination with rubber-lined, glass-lined, Haveg or other non-metallics, which makes possible the design of special equipment which formerly was not thermally efficient due to the materials that were available for fabrication. This advantage is particularly useful in the construction of evaporators, which now can be built with tubes and sheets of this material combined with chambers of an alloy or of steel lined with rubber, ceramics, glass or lead. This results in heat transfer surfaces of high conductivity combined with insulating surfaces of low conductivity. When used in combination with metals, consideration has to be given to the possibility of electrolytic action.

The standard nozzle connections on these exchangers permit ready installation with piping connections of almost any material of construction.

FIG. 1

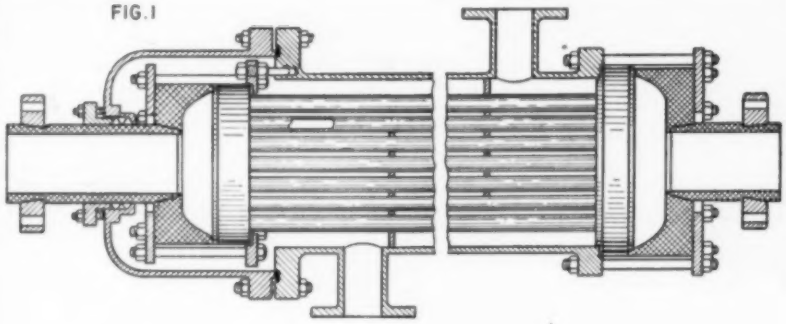


FIG. 2

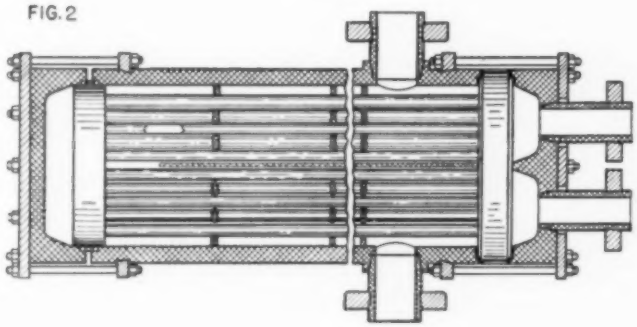
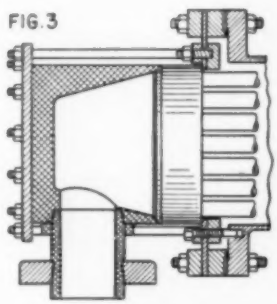


FIG. 3



Three typical floating head constructions (left end of exchanger) to allow for difference in thermal expansion between shell and tube bundle. Movement is permitted in Fig. 1 by metal cover over floating head and packing around nozzle; in Fig. 2 by double packed joint on periphery of floating tube sheet; in Fig. 3 by flexible diaphragm between shell and floating head

Where severe corrosion problems exist, it is often desirable to employ lines and fittings of impervious graphite throughout the entire system.

Cemented joints are usually employed when elements are assembled in the manufacturer's plant and the resulting bonds are normally stronger than the stock. Field joints are readily made with threaded, flanged or with Flexlock* joints. Where connection to elements of the processing system necessitates latitude of movement, standard flexible connections are available. In the rare instances where field repairs are necessary, the easy machinability and adaptability of the material makes any replacement or alteration extremely simple.

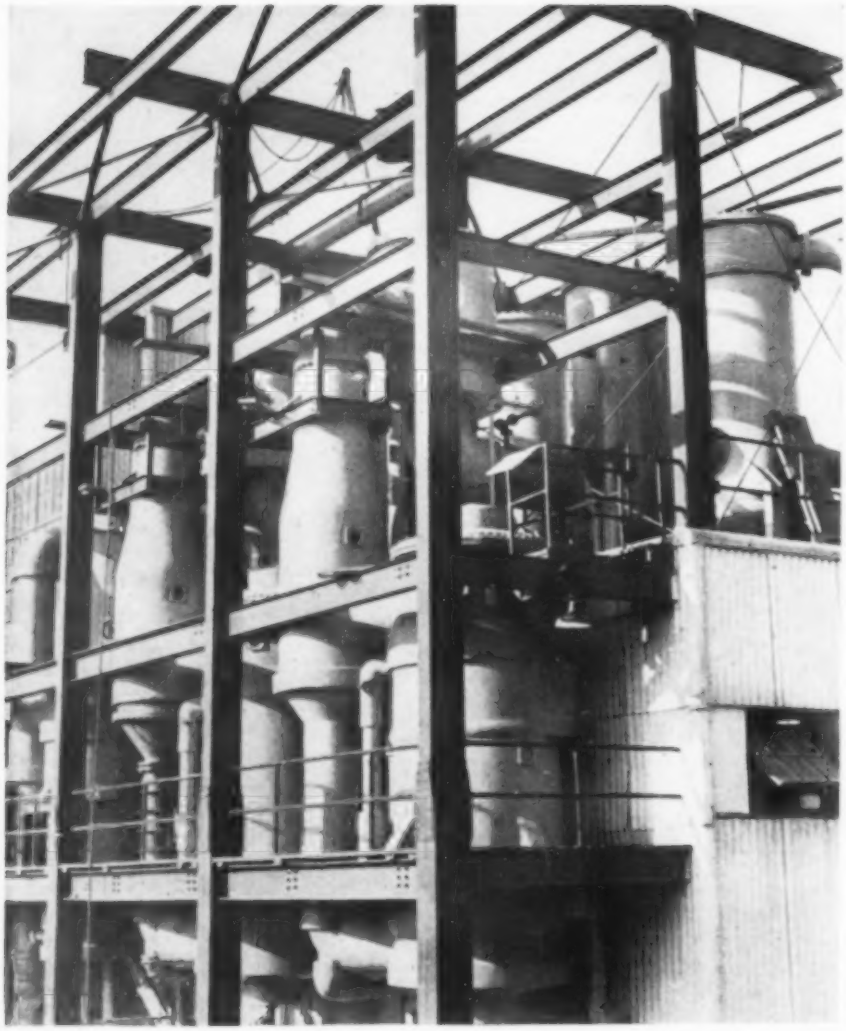
Through the cooperation of a number of leading fabricators of impervious graphite tube heat exchange equipment†, several examples of impervious graphite tube heat exchanger ratings have been made available and are listed below. The reader should bear in mind that these are application and design data and not just information gained from an occasional test. However, precise details regarding the composition and proportion of the fluids carried may not be disclosed, and users who might attempt designs based on these examples would do well to rely chiefly upon the broad experience of the fabricator who builds their units.

Acetone Condenser

Performance Design — Total heat transferred, 9,300 B.t.u. per hr., condensing 41.5 lb. per hr. of acetone isothermally at 134 deg. F., and 14.7

*Registered trade mark of the Flexlock Corp.

†The author gratefully acknowledges the cooperation of many fabricating companies which assisted with specific examples and design data as well as editorial review. The leading fabricators in this field are: Alberger Heater Co., American Locomotive Co., Buflovak Equipment Division of Blaw Knox Co., Croll Reynolds Engineering Co., Downingtown Iron Works, Fansteel Metallurgical Co., Foster Wheeler Corp., Goslin Birmingham Manufacturing Co., M. W. Kellogg Co., Patterson-Kelley Co., Pfaudler Company, Struthers Wells Corp., Swenson Evaporator Division of the Whiting Corp., Whitlock Manufacturing Co., Worthington Pump and Machinery Corp., Zaremba Evaporator Co.



Several large single effect evaporators employed in concentrating sulphuric acid solutions. "Karbate" tubes are used in heating elements to provide high heat transfer. Balance of construction is of lead-covered and rubber-lined steel

p.s.i. abs. pressure, using 1,860 lb. per hr. of cooling water heated from 55 to 60 deg. F., at 60 lb. maximum working pressure.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel.

HCl Reboiler

Performance Design — Total heat transferred 1,400,000 B.t.u. per hr., vaporizing 14 percent aqueous HCl at 250 deg. F., and atmospheric pressure, using 1,540 lb. per hr. steam at 50 p.s.i. gage pressure. Vertical thermosyphon reboiler design, with solution vaporizing inside tubes and steam condensing in shell side of unit.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel. Shell size is 21¼ in. I.D. with 6 ft. long tubes. The solution carried in this unit comes from a bath employed for the treatment of metal foil.

HCl and $AlCl_3$ Reboiler

Performance Design — Total heat transferred 180,000 B.t.u. per hr., vaporizing 80 percent of the HCl and $AlCl_3$ liquor flowing at 20 g.p.h., at 253.4 deg. F. and atmospheric pressure, using 196 lb. per hr. steam at 40 p.s.i. gage pressure. Vertical thermosyphon reboiler design, with solution vaporizing inside tubes, and steam condensing in the shell.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel. Shell 15¼ in. I.D. tubes 3 ft. long.

H_2SO_4 Dryer Precooler

Performance Design — Total heat transferred 305,000 B.t.u. per hr., cooling 22,000 lb. per hr. vapor (17,102 lb. per hr. Cl_2, 1,905 lb. per hr. CO_2, 308 lb. per hr. H_2O, 1,785 lb. per hr. air) from 85 to 55 deg. F. at 13.7 p.s.i. abs. pressure with 4 in. H_2O maximum pressure loss, using 122 g.p.m. of cooling water heated from 45 to 50 deg. F., at 50 lb. maximum working pressure.

Construction — Two shells per unit connected in parallel. Tubes, channel, floating head cover, stationary and floating tube sheets all of impervious graphite. Shell and baffles of steel. Shell 23¼ in. I.D., tubes 9 ft. long.

Alcohol and HCl Condenser

Performance Design — Total heat transferred, 180,200 B.t.u. per hr., condensing 405 lb. per hr. of ethyl alcohol and 5 percent HCl, cooling it from 95 to 65 deg. F. under 100 mm. vacuum, using 18,020 lb. per hr. of cooling water heated from 55 to 65 deg. F. at 60 lb. maximum working pressure.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel.

HCl Condenser

Performance Design — Total heat transferred 408,000 B.t.u. per hr., condensing 400 lb. per hr. of HCl and water vapor (about 21 percent HCl, 79 water) isothermally at 125 deg. F. under 26 in. vacuum, using 20,400 lb. per hr. of cooling water heated from 59 to 79 deg. F. A vertical installation.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel. Shell 12 in. I.D., tubes 6 ft. long.

Tetrachlorethane Condenser

Performance Design — Total heat transferred 918,500 B.t.u. per hr., condensing 1,884 lb. per hr. of tetrachlorethane and water (1,000 lb. per hr. tetrachlorethane, 884 lb. per hr. water) isothermally at 206 deg. F., and atmospheric pressure, using 33,250 lb. per hr. of cooling water heated from 82.4 to 110 deg. F. Unit installed at 45 deg. angle.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel. Packed floating head design. Shell 10 in. I.D., tubes 9 ft. long.

HCl Condenser

Performance Design — Total heat transferred 915,000 B.t.u. per hr., condensing 1,000 lb. per hr. of HCl and steam (200 lb. per hr. HCl, 800 lb. per hr. steam) at 118 deg. F. under 28 in. Hg vacuum with 4 mm. Hg

pressure loss, using 91.5 g.p.m. of chilled water heated from 40 to 60 deg. F. Vacuum pulled on the system by means of an impervious graphite jet.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel. Shell 17¼ I.D., tubes 9 ft. long.

Electrolyte Heater

Performance Design — Total heat transferred 27,000,000 B.t.u. per hr., heating 1,500 g.p.m. of electrolyte from 116.6 to 150 deg. F. in two-pass operation at a velocity of 6.4 ft. per sec. with pressure drop of 3 p.s.i., using 26,600 lb. per hr. steam at 5 p.s.i. gage working pressure.

Construction — Two shells per unit connected in parallel. Tubes, floating and stationary tube sheets of impervious graphite, channel and floating head cover of rubber lined cast iron. Shell and baffles of steel. Shell 23¼ in. I.D., tubes 9 ft. long.

Electrolyte Heater

Performance Design — Total heat transferred 300,000 B.t.u. per hr., heating 27.8 g.p.m. of bright nickel electrolyte from 140 to 158 deg. F. in a two-pass operation at a velocity of 5 ft. per sec. with pressure drop of 5 p.s.i., using 314 lb. per hr. steam at 7 p.s.i. gage working pressure.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel. Shell 6 in. I.D., tubes 9 ft. long.

HCl, HCN, SO_2 and H_2O Condenser

Performance Design — Total heat transferred 48,800 B.t.u. per hr., condensing 72 lb. per hr. of HCl, HCN, SO_2 and H_2O vapors isothermally at 185 deg. F., and 14.7 p.s.i. abs. pressure using 4,880 lb. per hr. of chilled water heated from 55 to 65 deg. F., at 60 lb. working pressure.

Construction — Tubes, channel, floating head cover, floating and stationary tube sheets of impervious graphite. Shell and baffles of steel.

Viscose Spin Bath Evaporator

Performance Design — Total heat transferred 25,460,000 B.t.u. per hr., evaporating 20,800 lb. per hr. of H_2O on the tube side from a feed of 770 g.p.m. of an aqueous solution of H_2SO_4 and Na_2SO_4 (8.5 percent H_2SO_4, 21.0 percent Na_2SO_4) at 3.5 in. Hg abs., condensing 28,000 lb. per hr. steam in the shell at 15 p.s.i. gage pressure. M.T.D. (non-boiling) 115 deg. F. M.T.D. (boiling) 110 deg. F.

Construction — Tubes of impervious graphite held in heavy antimonial lead tube sheets by special ring gaskets. Liquor head of rubber lined steel. Shell of steel. Shell 4 ft. 8¼ in. I.D., tubes 9 ft. long.

CORROSION RESISTANCE OF STEEL AND CAST IRON

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Chemical Engineering's Twelfth Report on Materials of Construction (Nov. 1946) lists almost 600 materials and gives data on the chemical resistance of many of them. Scant data, however, is given for ordinary iron and steel, which are used for chemical construction more than any of the materials named. The data below have been specially compiled to help fill the gap.

Steel and cast iron are readily available, inexpensive, easily fabricated, and possess good mechanical properties. For some purposes—solvent tanks, piping and pumps, for example—they do not corrode appreciably and are as satisfactory as more expensive materials. Where some corrosion does occur, the rate in many cases is low enough to make iron or steel the most economical selection—provided iron contamination is not objectionable and provided replacement does not have to be made so frequently that installation costs outweigh the saving on material.

The ratings used here are the same as those in the November Report and are intended to serve only as a starting point in determining the suitability of iron and steel for process equipment. Those rated "A" are generally satisfactory; "F" indicates that corrosion may be expected but is usually slow enough to make iron or steel the most economical selection if iron contamination can be tolerated; "V" means that the corrosion rate varies with concentration, temperature, purity, velocity, etc; and those rated "X" are usually regarded as unsatisfactory.

Before selecting iron or steel, every effort should be made to check the given rating against actual plant performance data. If this is impossible to obtain, laboratory tests simulating actual conditions should be run, although such tests are frequently unreliable. In no case should the ratings be used as anything more than a preliminary guide.

Corrosive Agent	Cast Iron	Steel	Remarks
Acetic acid	V	X	Crude acid only.
Acetic anhydride	V	V	
Alum	X	X	
Aluminum chloride	X	X	Aqueous solutions.
Aluminum sulphate	X	X	
Amines	A	A	
Ammonia, ammonium hydroxide	A	A	
Ammonium chloride	F	F	Frequently used.
Ammonium phosphate	A	A	Tribasic only, others F.
Ammonium sulphate	F	F	
Benzol	A	A	
Boric acid	X	X	
Bromine	X	X	
Calcium chloride	F	F	Frequently used. Inhibitors useful in reducing corrosion.
Calcium hypochlorite	V	X	
Carbon tetrachloride	A	A	Dry only.
Carbonic acid	F	F	
Chloracetic acid	X	X	
Chlorine	A	A	Dry gas only.
Chromic acid	F	F	
Citric acid	X	X	
Copper sulphate	X	X	
Fatty acids	X	X	Sometimes used on crude products.
Ferric chlorides	X	X	
Ferric sulphate	X	X	
Ferrous sulphate	F	F	
Formaldehyde	F	F	Used where discoloration is not objectionable
Formic acid	X	X	
Hydrocarbons (aliphatic)	A	A	Standard material of construction
Hydrocarbons (aromatic)	A	A	Standard material of construction.
Hydrochloric acid	X	X	
Hydrogen peroxide	F	F	
Hydrofluoric acid	X	A	Steel A for acid over 75 percent, low temp., non-aerated
Iodine	X	X	
Lactic acid	X	X	
Magnesium chloride	F	F	Frequently used.
Mixed acid	A	A	Less than 20 percent H_2O and more than 15 percent H_2SO_4
Nitric acid	X	X	
Oleic acid	F	F	
Oxalic acid	F	F	
Phenol, cresol and similar acids	A	A	Where color is not important. Do not use with C. P. acid.
Phthalic acid	X	X	
Phthalic anhydride	A	A	
Phosphoric acid	F	F	Crude only over 70 percent.
Sodium bisulphate	X	X	
Sodium carbonate	A	A	
Sodium chloride	F	F	Frequently used.
Sodium hydroxide	A	A	Up to 70 percent sol. under 200 deg. F., low velocities.
Sodium hypochlorite	X	X	
Sodium nitrate	A	A	
Sodium sulphate	A	A	
Sodium sulphite	A	A	
Sodium thiosulphate	A	A	Do not use if iron contamination is not permissible.
Sodium sulphide	A	A	
Stearic acid	F	F	
Sulphur	A	A	
Sulphur dioxide	A	A	Dry gas only.
Sulphuric acid	A	A	Over 90-percent acid.
Sulphurous acid	X	X	
Trichlorethylene	A	A	Dry only.

Handling Solids-Gas Reactions by FLUIDIZATION

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THE AUTHOR PRODUCES EQUATIONS FOR FLUIDIZED SOLIDS-GAS REACTION SYSTEMS HAVING EITHER SINGLE OR MULTIPLE REACTION ZONES

An earlier article (January 1947) laid some of the groundwork for the use of fluidization in chemical industry problems where the fluidized material itself enters into the reaction. Applications of this sort, such as coal gasification and lime calcination, are rapidly becoming of interest, although all previous experience has been gained with fluidized solids used only as a catalyst. Following the general discussion of the first article, the present article carries on with the development of the main equations needed in producing data essential for design.

IN AN EARLIER article (Kalbach, *Chem. Eng.*, Jan. 1947, p. 105) some of the problems involved in the use of fluidized systems for gas-solid reactions were considered, along with a discussion of advantages and disadvantages. It was brought out that in such systems temperature control and heat transfer are superior and that higher reaction rates may be secured, as compared with stationary solids beds, but it was also shown that multiple vessel set-ups must sometimes be used, either to reduce needed vessel height, minimize short circuiting or to permit the approximation of counterflow.

It was pointed out that there are two principal sorts of solid-gas reaction that may be handled by fluidizing: the first where one or more of the reaction products remains solid; the second where all of the principal reaction products become gaseous. The peculiarities of each type system were discussed. In addition, the article considered the effect of particle size, methods of obtaining design data, and the determining of reaction order. It was shown that the time t_e during which the gas is exposed to the solids is easily calculated as:

$$t_e = W_s/\rho_f A v_g \qquad (1)$$

where W_s is weight of solids in the fluid bed; ρ_f is the apparent density of the fluid bed at gas velocity v_g; A is the vessel's horizontal cross-sectional area; and v_g is the linear velocity of the gas, conventionally calculated as if the solids were absent.

On the other hand, the time that the solids reside in the reaction vessel is not a simple function, since any given particle may remain for any period up to the length of time that the fluid bed has been in existence. It is necessary, therefore, to determine a relationship by which the proportion of particles that has remained in the fluid bed for various given periods can be calculated.

Single Reaction Vessel

As far as the solids are concerned, the fluidized bed may be considered as an efficient mixing chamber. Ham and Coe showed previously[1] that in such systems,

$$dN_1/d\theta = -aN_1 \qquad (2)$$

or $$N_1 = e^{-a\theta} \qquad (3)$$

where N_1 is the fraction of feed particles remaining in the zone longer than time θ. The constant a has the significant value

$$a = 1/t_e \qquad (4)$$

where t_e is the change-over time of a single vessel or the time during which the vessel would empty itself if the inflow of feed were stopped and the discharge rate continued unabated. The point that t_e is based on the rate of outflow of solids and not on the feed rate is important where solids are gained or lost in the reaction. Constant a has the same dimensions as the unit of space velocity widely used in catalyst work but usually has a much smaller numerical value.

The change-over time t_e can be related to t_e by the following equation:

$$t_e = \frac{v_g t_e \rho_f A}{W_p} = \frac{W_s}{W_p} \qquad (5)$$

where W_p is the weight rate of withdrawal of solids from the vessel. A diagram which attempts to illustrate some of the flow peculiarities of a fluid system and to indicate the meaning of certain of the above symbols is given in Fig. 1. The two vessels shown are actually the same vessel, that on the left indicating the straight-through flow of the gas, that on the right showing how the solids constantly mix and recirculate within the vessel.

Returning to the experimental results, instantaneous data from batch-wise runs conducted as mentioned in the first article will include analyses of the outgoing gas and of the solid bed. These can be calculated over to give the extent of reaction of the solid particles expressed in terms of i_s, the fraction of the starting solid reactant remaining, and the rate of change of i_s or $di_s/d\theta$, where θ is the residence time of the solid. By choosing data from various runs corresponding to

the same temperature, and inlet and outlet gas composition and gas velocity (selected according to tentative process decisions), it will be possible to set up a more or less empirical function:

$$di_s/d\theta = f(i_s) \quad (6)$$

and to solve to the forms

$$i_s = f'(\theta) \quad (7)$$

$$\text{and } di_s/d\theta = f''(\theta) \quad (8)$$

When $f(i_s)$ takes the form of a simple linear or power function (i.e., the reaction behaves as if it belongs to a low order, or available reaction surface controls), Equations (7) and (8) will be readily usable later. But, for instance, where shell effects on the particle surfaces are important, these equations become rather awkward and require graphical treatment in later stages of the calculations.

If a value of t_c be now chosen, the following relationship holds:

$$dI_s/d\theta = (1 - \iota)/t_c \quad (9)$$

where $dI_s/d\theta$ refers to the rate of reaction of the bed as a whole, as distinct from $di_s/d\theta$ which refers to individual particles or to groups of particles having the same residence time in the bed, and ι is the fraction of starting solid which it has been decided to tolerate in the product. Note that the fractions referred to throughout this discussion are based on the incoming quantity of solids and do not in general derive directly from instantaneous analytical results.

It is now possible to combine Equations (2), (3), (8) and (9) and integrate as follows:

$$\frac{{}^{\tau}dI_s}{d\theta} = \int_0^{\tau} ae^{-a\theta}\, d\theta f''(\theta) = a(1 - \iota) \quad (10)$$

The value of t_c (or $1/a$) which satisfies Equation (10) should give satisfactory gas and solid products. The upper limit of integration τ is the value of θ which satisfies Equation (7) when $i_s = 0$. It is infinity in many cases. For simple reaction orders the solution of Equation (10) for a will present no particular difficulties. In other cases graphical integration with trial values of a must be performed.

Equations (2), (3) and (7) may be combined and integrated as follows:

$$I_s = \int_0^{\tau} ae^{-a\theta}\, d\theta f'(\theta) \quad (11)$$

The result of solving Equation (6) may be fed into either Equation (10) or (11), the latter being used where a very complete consumption of the solid is desired. The other equation may then be used for checking.

The value of t_c can be converted by Equation (5) to a value of bed height $v_g t_c$, the term W_g/A in that equation being calculated stoichiometrically from the gas velocity and ι. Bed heights as great as 30 to 40 ft. can be handled commercially. If the calculations call for a deeper bed, the use of two or more reaction zones should be considered.

The above calculations may be checked by considering the experimental data from another viewpoint and making use of the values for t_c and t_c already determined.

If the reaction data for the gas have been correlated to yield some form of velocity coefficient k_v for each of several degrees of reaction of the solid, a function of i_s can be written:

$$k_v = F(i_s) \quad (12)$$

Since the particles in the bed will affect the gas passing them quite as if the other particles were not present, the properties of the particles in this respect may be summed up by combining Equations (2), (3), (7) and (12) and integrating:

$$K_v = \int_0^{\tau} ae^{-a\theta}\, d\theta F\left[f'(\theta)\right] \quad (13)$$

Having thus evaluated K_v, the velocity coefficient for the bed as a whole, the gas reaction equations can be used with t_c to determine the degree of reaction of the gas. This should confirm satisfactory efficiency of gas consumption under the selected conditions. A graphical integration as shown in Fig. 2 may be useful at this point.

Multiple Reaction Zones

Aside from any advantage due to a countercurrent arrangement, the merits of compartmentalizing a reaction system in which perfect mixing can be assumed have often been discussed. Formulas for the residence time of material in each of a series of reaction stages with equal change-over times were published by Ham and Coe[1] but the present derivation is slightly more direct. The derivation is extended to cover the case where the reaction zones differ in change-over time. This state of affairs is rather likely to appear in practice, particularly where the products are gaseous and, in general, where a small "clean-up" stage is desired at the end of an operation.

We shall also point out the differences between the interpretation of the formulas for a series of fluid reactors, and for the more usual series of liquid-phase mixing chambers.

Consider first the case where each vessel in the series has the same change-over time. The symbols are defined as follows: N_n is the fraction of material residing in the nth vessel of the series at time θ after its introduction into the first vessel. Σ_n is the fraction of material remaining in a system of n vessels at the same time. Finally, t_{cn} is the change-over time of the nth vessel. As in Equation (4),

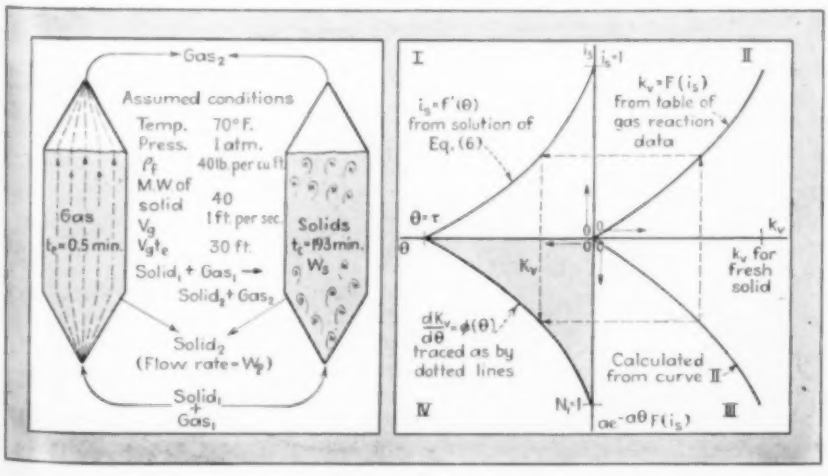
$$a = \frac{1}{t_{c1}},\ b = \frac{1}{t_{c2}} \ldots\ldots z = \frac{1}{t_{cn}} \quad (4a)$$

Equations (2) and (4) amount to the logical statement that, considering the infinitestimal quantity of material entering the first chamber at any given instant, the rate of withdrawal of that material at any subsequent time is equal to the quantity of it then residing in the chamber divided by the time needed to empty the chamber if inflow were stopped and outflow continued at the operating rate.

Equation (2) integrates easily to Equation (3), the constant of integration dropping out because $N_1 = 1$ when $\theta = 0$. Since the history of each bit of material entering the system is the same, Equation (3) is applicable to the bed as a whole.

In the second chamber, still focussing attention on the material which entered the first chamber at $\theta = 0$,

Fig. 1—Diagram showing how gas and solids flow in fluidized systems
Fig. 2—Typical graphical integration for velocity coefficient K_v



the amount of that material present will be continually changing by the inflow of particles from the first chamber and by outflow to the third. The differential equation is:

$$dN_2/d\theta = aN_1 - bN_2 \quad (14)$$

Since a = b = c, and substituting N_1 from Equation (3):

$$dN_2/d\theta = ae^{-a\theta} - aN_2 \quad (15)$$

This is readily soluble by methods given in standard texts to the form,

$$N_2 = e^{-a\theta}(a\theta + c) \quad (16)$$

From the starting conditions, $N_2 = 0$ when $\theta = 0$, we find $c = 0$ and

$$N_2 = a\theta e^{-a\theta} \quad (17)$$

Similar derivations show that

$$N_3 = \frac{a^2\theta^2}{2} e^{-a\theta} \quad (18)$$

and

$$N_n = \frac{a^{n-1}\theta^{n-1}}{(n-1)!} e^{-a\theta} \quad (19)$$

Since

$$n = N_1 + N_2 + N_3 \ldots\ldots N_n \quad (20)$$

then

$$\Sigma_n = e^{-a\theta}\left(1 + a\theta + \frac{a^2\theta^2}{2} \ldots\ldots \frac{a^{n-1}\theta^{n-1}}{(n-1)!}\right) \quad (21)$$

Useful charts and tables giving numerical values for N_n and Σ_n are shown by MacMullin and Weber[2].

By the same method formulas have been derived from N_1 to N_3 for the case where a, b, and c are all different.

$$N_1 = e^{-a\theta} \quad (3)$$

$$N_2 = \frac{a}{b-a}\left(e^{-a\theta} - e^{-b\theta}\right) \quad (22)$$

$$N_3 = \frac{ab}{b-a}\left(\frac{e^{-a\theta} - e^{-c\theta}}{c-a} - \frac{e^{-b\theta} - e^{-c\theta}}{c-b}\right) \quad (23)$$

These formulas follow a definite pattern but it is not easy to set up a concise formula for N_n. If a = b = c in Equation (23), an indeterminate expression of the form 0/0 results, which can be reduced to Equation (18) by methods given in standard texts.

The retention of material in any one vessel of a series can be expressed by Equation (3) but it should be remembered that only in the first vessel does the feed have a uniform composition and past history.

Equations of this type have generally been developed for the discussion of homogeneous reaction systems or of heterogeneous systems where there is little or no lag of one phase behind the other or difference in flow pattern between the phases. Reaction calculations are then relatively simple because the exposure time of the components of the system to reaction conditions is the same and fractional distribution of the exposure times of all components is expressed by the above equations.

In contrast, a fluid system is characterized by a much shorter residence time of gas than of the solid and, as has already been pointed out, by an entirely diffe ent flow pattern for the two phases. The above equations apply only to the behavior of the solids. In cases where some of the reaction products remain solid, the condition of equal t_e for the several vessels will be met by zones of approximately equal size. When, however, the principal reaction products are gaseous, equal values of t_e will require vessels which decrease in size in the direction of solids flow. In the comparatively rare case in which solids are formed in the reaction, the vessel size will increase in the same direction.

It is interesting to point out one more difference between a multi-vessel system handling a fluidized solid reactant, and a system handling a true liquid. In the latter, the individual particles whose time-position behavior is described by the equations are molecules which lose their identity in the mass of liquid in each vessel, are invariant as to their individual reactivity and have their chemical properties on an "is or ain't" basis. In the former the solid particles have their past history indelibly written into their chemical composition and what happens to them subsequently is determined thereby.

When it comes to calculating the reactions and dimensions for a series of con- or countercurrent stages, one of several possible attacks is to make a tentative decision as to the analysis of gas entering and leaving each stage.

The calculations may require additional data over and above those needed for estimating a single zone. The data may be provided by batch-wise runs in which the feed and product gas composition are controlled in the range predicted for step-wise operation. Continuous runs may be made but the accurate control of solid feed rates on the laboratory scale presents some problems.

Granted the necessary preliminary data, the treatment of the reaction stage into which fresh solids are introduced can be identical with that for a single zone. The calculations will reveal not only the vertical dimension of the reaction stage but also the distribution of particle compositions in the outgoing solids.

As a first approximation the average outgoing solids composition from the above may be considered as if it were the uniform analysis of the particles, and the above calculations repeated for the next stage.

For this purpose the equations require some modification. In Equation (10), $f''(\theta)$ takes the form appropriate to conditions in the second stage and becomes $f''(\theta' + \theta_1)$ where θ' refers to residence time in the second stage and θ_1 is the time obtained by substitution in Equation (7), written for conditions in the second stage, of the value of I_e corresponding to the feed conditions of the second stage. Equation (10) then becomes:

$$\frac{dI_e}{d\theta'} = \int_0^{\tau-\theta_1} f''(\theta' + \theta_1)\, be^{-b\theta'}\, d\theta' \quad (24)$$

Equation (11) becomes:

$$I_e = \int_0^{\tau-\theta_1} f'(\theta' + \theta_1)\, be^{-b\theta'} d\theta' \quad (25)$$

Equation (13) becomes:

$$K_e = \int_0^{\tau-\theta_1} F\left[f'(\theta' + \theta_1)\right] be^{-b\theta'} d\theta' \quad (26)$$

It is more precise but much more troublesome to treat each portion of solid entering the second stage as a separate feed and sum the resultant products.

In those fortunate examples of reactions with gaseous products, where the reactivity of the solid does not change too markedly as it passes through the process, it will be a reasonable approximation to treat the whole system of several stages as if it were actually one. For $(ae^{-a\theta})$ in Equations (10), (11), and (13) is substituted $(-d\Sigma_n)$ or (zN_n), this expression being taken from Equations (19), (22) or (23) as required.

In the development of any given chemical process utilizing the fluid technique to achieve a solid-gas reaction there is considerable latitude for ingenuity in circumventing the various special problems that arise. The attempt here has been merely to point out some general methods of calculation and some interesting similarities and differences as compared to longer-established techniques. There has been no discussion of actual process flow sheets, but the patent literature is rife with suggestions along these lines.

In conclusion, thanks are due to Paul W. Garbo for helpful suggestions in the writing of this paper.

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1. Ham, A. and Coe, H. S., Calculation of Extraction in Continuous Agitation, *Chem. & Met.*, 19, 663 (1918.)
2. MacMullin, R. B. and Weber, Jr., M., Theory of Short Circuiting in Continuous Flow Mixing Vessels in Series, *Trans.* A. I. Ch. E., 31, 409 (1935).

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the February winner will be announced in March, and his article published in April. Judges will be the editors of *Chemical Engineering.* Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at applicable space rates.

Any reader of *Chemical Engineering,* other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are considered.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering,* 330 West 42nd St., New York 18, N. Y.

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A $50 prize will be issued to

JOHN G. KIRKPATRICK
Instrument Engineer, Koppers Co.
Pittsburgh, Pa.

For an article describing an ingenious application of a differential pressure controller to interface control, that has been judged the winner of our January contest.

This article will appear in our March issue. Watch for it!

December Contest Prize Winner

AUTOMATIC SEPARATOR FOR IMMISCIBLE LIQUIDS AVOIDS POSSIBILITY OF SIPHONING

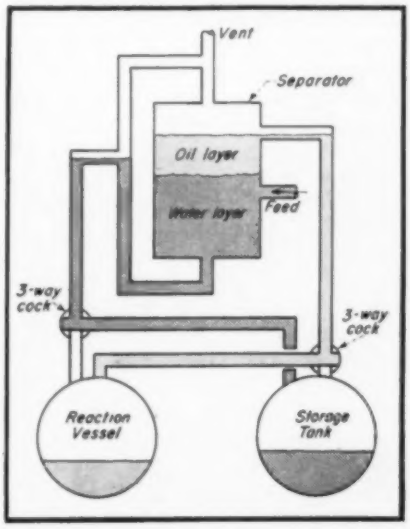
GERALD V. O'CONNOR
Evans Chemetics, Inc., Waterloo, N. Y.

A PROPOSED new organic synthesis included a steam distillation step in which the operation was to be divided into two stages. In the first phase, the light oil layer was to be returned to the reaction vessel, and the heavy water layer sent to storage. In the second stage, the water layer was to be returned to the reaction vessel, and light oil sent to storage.

The problem called for the design of an automatic separator to do both jobs, with a maximum amount of insurance against the siphoning effect present in many separator and piping designs, and with a minimum amount of attention from the operator. The separator described on page 197 of "Chemical Engineering for Production Supervision" (Pierce, McGraw-Hill) is not siphon-proof, since any connection to the heavy liquid discharge line which is run below the separator will cause the entire contents of the separator to discharge by siphoning. We would, in effect, have a Sohxlet extractor on a large scale.

To make such a separator work, it would be necessary for the operator to watch the apparatus continuously, periodically opening a valve in the discharge line each time an appreciable amount of heavy liquid had accumulated, and closing the valve before any light liquid could discharge. If this siphoning effect could be eliminated, no valves at all would be necessary on the separator itself, and the valves on the tanks would need to be touched only between the first and second operating stages.

Non-siphoning automatic separator



The drawing given here illustrates the design of a separator to do this job. This separator could be made of glass for visual observation of the course of the reaction if desired. To return light liquid to reaction vessel and store heavy liquid, it is only necessary to turn both three-way cocks to the horizontal position. To return heavy liquid to the reaction system and store light liquid, both cocks are turned to the vertical position. If desired the cocks can be mechanically interconnected.

THREE COMPONENT MIXING COMPUTED GRAPHICALLY

MURLIN T. HOWERTON
College Station, Texas

IN CERTAIN blending operations, it is frequently necessary to produce a three component mixture in which two properties are within certain specified limits. In gasoline blending for example, isopentane, and alkylate, and a straight run gasoline are blended to give a mixture of specified octane number and vapor pressure. The cal-

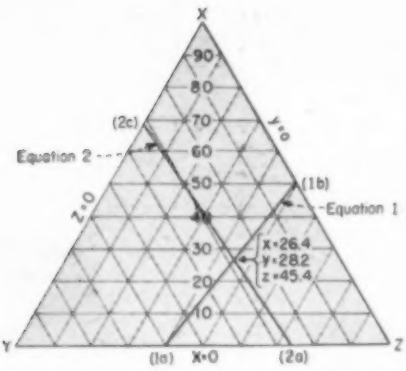


Chart for ternary mixture calculations

culations, involving three equations and three unknowns, require considerable algebraic manipulation to obtain a solution. Without impairing the accuracy, the calculations can be greatly simplified by a graphical solution.

The equations involved are of the general type,

$$x(A_x) + y(A_y) + z(A_z) = 100(A_m) \quad (1)$$

$$x(B_x) + y(B_y) + z(B_z) = 100(B_m) \quad (2)$$

where x, y, and z represent weight, volume, or mol percent; and A and B represent additive properties of the individual components and the final mixture.

A third relation, $x + y + z = 100$, is a fundamental property of the triangular coordinate system used in the graphical solution.

Since the equations are linear, only two points are necessary to plot one equation. The two end points of each curve are readily found by applying the following conditions:

(a) Let $x = 0$ in Equation (1) and in Equation (2):

$$(1a)\ \frac{y(A_y) + z(A_z) = 100(A_m)}{y + z = 100}$$

$$y = 100\,\frac{(A_m - A_z)}{(A_y - A_z)}$$

$$(2a)\ \frac{y(B_y) + z(B_z) = 100(B_m)}{y + z = 100}$$

$$y = 100\,\frac{(B_m - B_z)}{(B_y - B_z)}$$

(b) Let $y = 0$ in both equations:

$$(1b)\ x = 100\,\frac{(A_m - A_z)}{(A_x - A_z)}$$

$$(2b)\ x = 100\,\frac{(B_m - B_z)}{(B_x - B_z)}$$

(c) Let $z = 0$ in both equations:

$$(1c)\ x = 100\,\frac{(A_m - A_y)}{(A_x - A_y)}$$

$$(2c)\ x = 100\,\frac{(B_m - B_y)}{(B_x - B_y)}$$

From the statement of the problem it will be evident that two of the above six conditions will give negative or otherwise impractical solutions.

Sample Calculation — A gasoline blend having an octane rating of 100 and a vapor pressure of 7.0 psi. abs. is to be made from a straight run gasoline of 85 octane, and 0.6 vapor pressure; isopentane of 90 octane, and 21.0 psi. abs.; and an alkylate having an octane rating of 115 and a vapor pressure of 2.0 psi. abs. Let x = mol percent gasoline; y = mol percent isopentane; z = mol percent alkylate; and the blend = 100 percent.

Then:

A_x = 85 octane B_x = 0.6 psi. abs.
A_y = 90 octane B_y = 21.0 psi. abs.
A_z = 115 octane B_z = 2.0 psi. abs.
A_m = 100 octane B_m = 7.0 psi. abs.

Substituting in the equations derived above for Equation (1) and noting that z cannot be 0,

(1a) When $x = 0$,

$$y = 100\,\frac{(100 - 115)}{(90 - 115)} = 60$$

(1b) When $y = 0$,

$$x = 100\,\frac{(100 - 115)}{(85 - 115)} = 50$$

Substituting in the equations derived above for Equation (2) and noting the y cannot be 0,

(2a) When $x = 0$,

$$y = 100\,\frac{(7 - 2)}{(21 - 2)} = 26.3$$

(2c) When $z = 0$,

$$x = 100\,\frac{(7 - 21)}{(0.6 - 21)} = 68.6$$

Equations (1) and (2) are plotted in the accompanying diagram. The intersection of the two lines gives the desired composition. Reading from the figure, x = 26.4 mol percent gasoline; y = 28.2 mol percent isopentane; z = 45.4 mol percent alkylate.

GRAVITY AND pH SAMPLER FOR CLOSED VESSELS

F. L. CULLER, JR.
Chemical Engineer, Oak Ridge, Tenn.

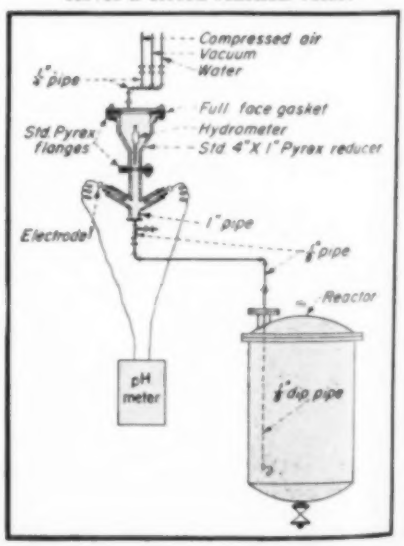
It is often necessary to measure the pH and specific gravity of the contents of a closed reaction vessel. To draw off a sample for analysis at some location remote to the reactor is time consuming and cumbersome. The use of the sampler shown in the sketch makes it possible to obtain instantaneous measurements of pH and specific gravity at the reactor. This system also works to advantage with a small vessel in which a submersion type pH electrode assembly would require too much space, or in a unit where agitation would make the accurate measurement of pH impossible.

The sampler is constructed of a standard 4 in. to 1 in. Pyrex reducer with a stainless steel cover flange into which the outlet for the air-vacuum-water manifold is welded. A stainless steel pH electrode holder is attached to the 1-in. end of the Pyrex reducer by means of a standard adapter flange for 1-in. pipe. The electrode holder is fabricated from 1-in. stainless steel pipe, and a 1-in. stainless steel welding flange, annealed after welding. The dip pipe in the reactor should extend to within 3 or 4 in. of the bottom of the reactor. A tee with two stainless valves is installed at the base of the electrode holder as shown. The pH meter electrodes are inserted in the holders through a synthetic rubber stopper. A bulb type hydrometer is installed in the 4 in. to 1 in. Pyrex reducer.

In order to obtain a sample, the sample line valve is opened and blown out by cracking the air valve on the manifold. The air valve is closed and the vacuum valve then opened. Solution is drawn into the sampler until the hydrometer floats, then the valves on the sample and vacuum lines are closed. Readings of pH and specific gravity are then taken. The solution is blown by compressed air into the reactor. Wash water is then admitted to the sampler, then drained either to the reactor or to waste through the drain valve. After the drain valve is closed, more water is added to cover the pH meter electrodes until the next sample is taken.

Materials of construction can be changed, of course, to agree with the dictates of economy and specific corrosion conditions.

Combination pH and gravity sampler serves a closed reaction vessel



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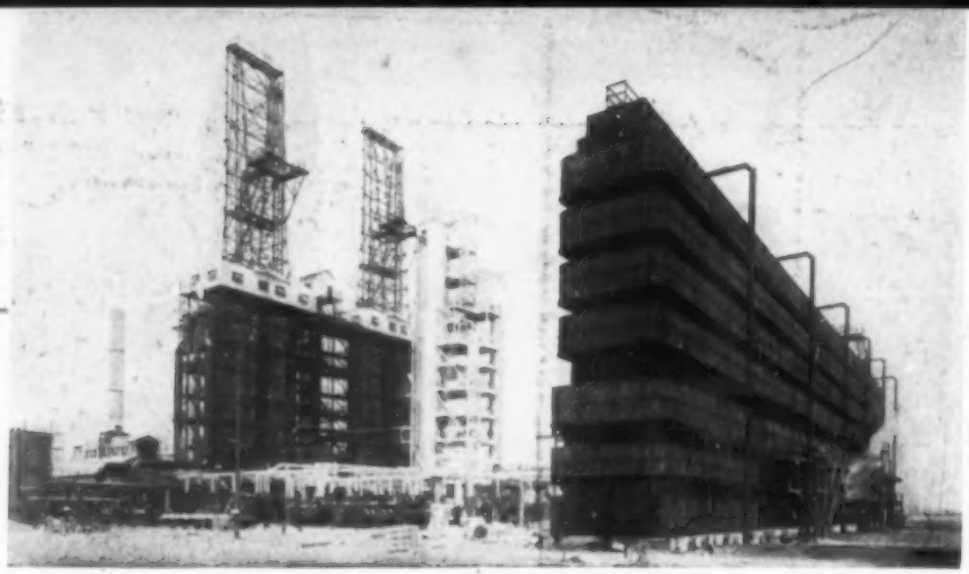


15,000-bbl. per day delayed coking unit at General Petroleum Corp's Torrance, Calif., refinery. It is the largest unit of its kind in the world

DELAYED COKING

A TREND in petroleum refining is a more extensive cracking of residuum fraction. It has been estimated that this trend, in the next decade or two, will reduce the average percentage residuum from the present 26 to some 10 percent. It is not expected that this cracking of heavier stock will so much replace light oil cracking as that it will provide the requisite charge stock.

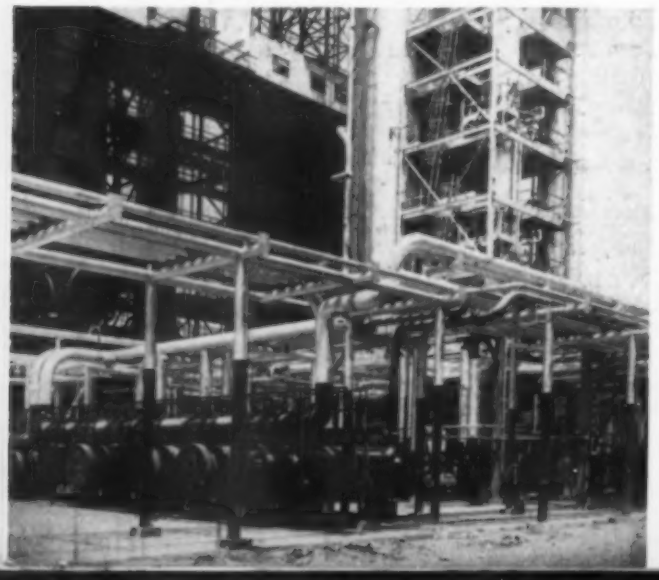
The General Petroleum Corp. has contributed to this trend by installing a 15,000 B/D delayed coking unit to process 300-700 ft. SSF/122 deg. F. straight run residuum. The gas oil thereby obtained will serve to supply part of the feed stock to the four TCC Units. The coking unit was designed, engineered, and constructed by M. W. Kellogg Co., and incidentally is the largest unit of its kind in the world.

The description of the general process may best be followed by referring to the flowsheet. The coking portion of the unit is divided into two sections each with its own furnace and pair of coke drums to be used alternately. The cracked products from the two coking sections enter a common bubble tower for fractionation into an overhead product of gasoline and lighter, three gas oil draw products, and a bottoms recycle product. The straight run residuum charge, or reduced crude charge as it is also called, is introduced into the bubble tower for further reduction with the bulk of it appearing in the bottoms for furnace charge. Three strippers for the sidedraw streams and a gasoline debutanizer complete the fractionation equipment.

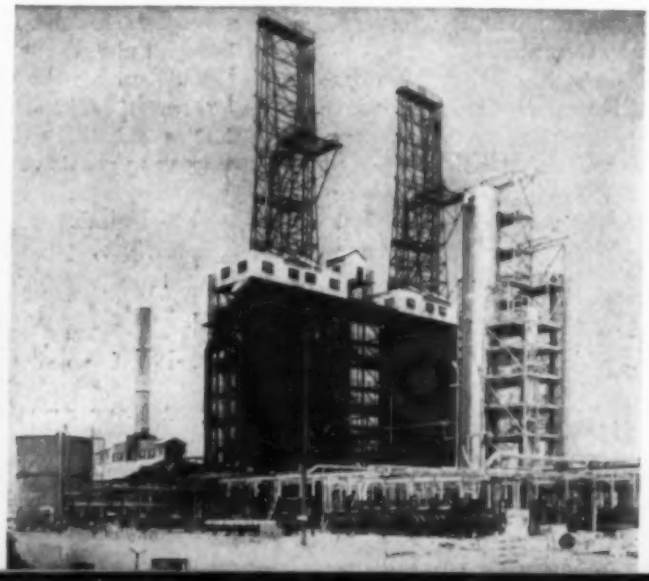
The unit is quite flexible in that it can be used either as a coker, a visbreaker, or any combination of these two. For any operation other than full coking a higher inlet to the coke drum would be used. The rate of residuum withdrawal from the bottom of the drum would determine the amount of coking permitted. In a full visbreaking operation, it is also possible to charge the fresh feed directly to the furnace along with the recycle. Under this arrangement, the residuum would be removed from the bubble tower bottom and the recycle from the bottom draw.

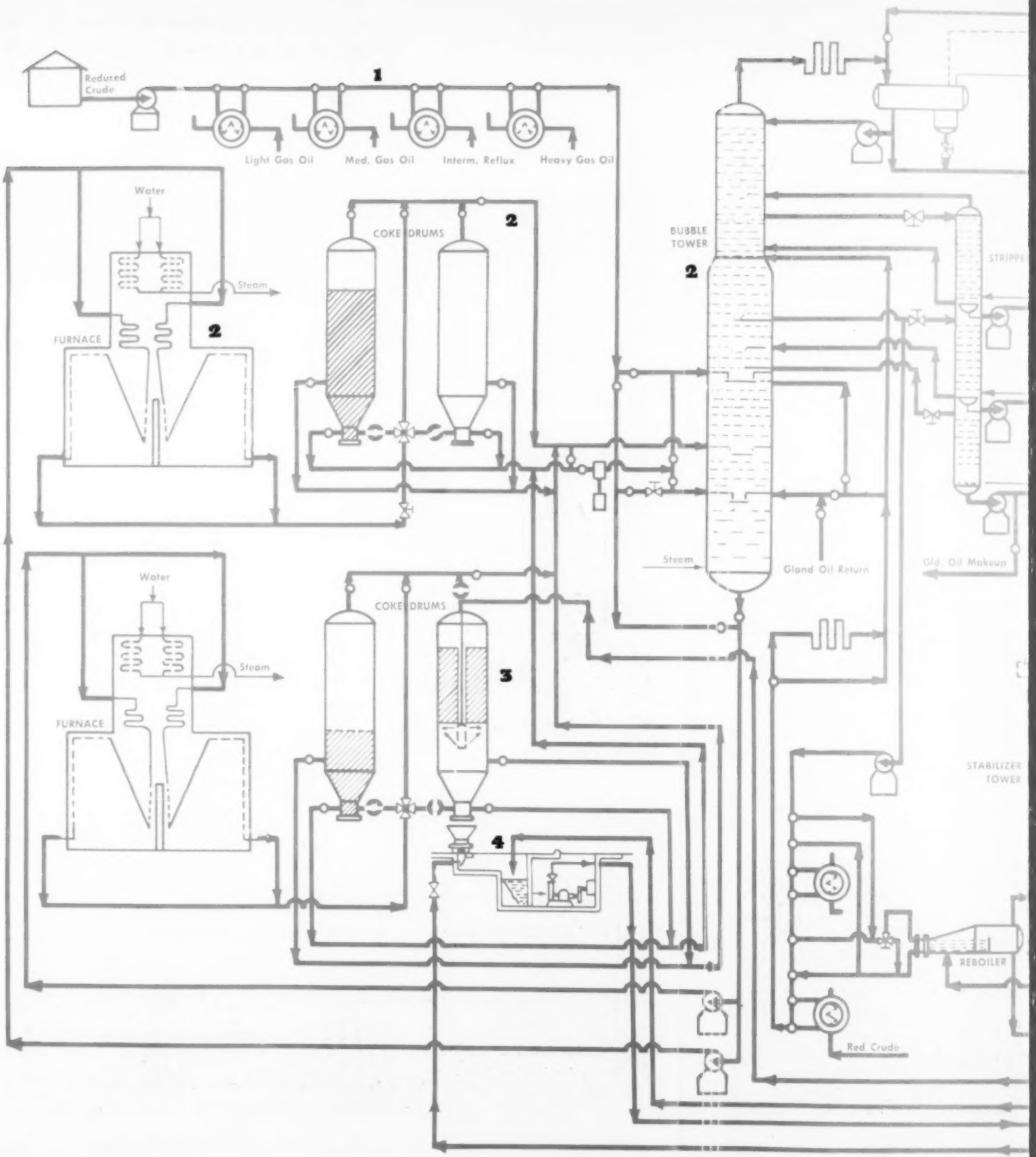
CHEMICAL ENGINEERING
February, 1947
PAGES 142 TO 145

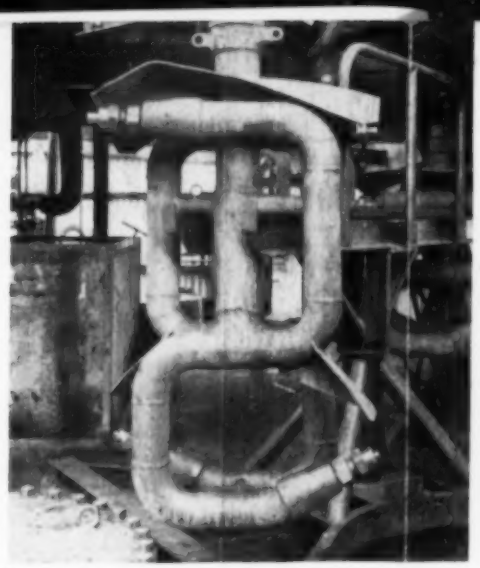
1 Reduced crude is preheated in heat exchangers in foreground before entering bubble tower at two points



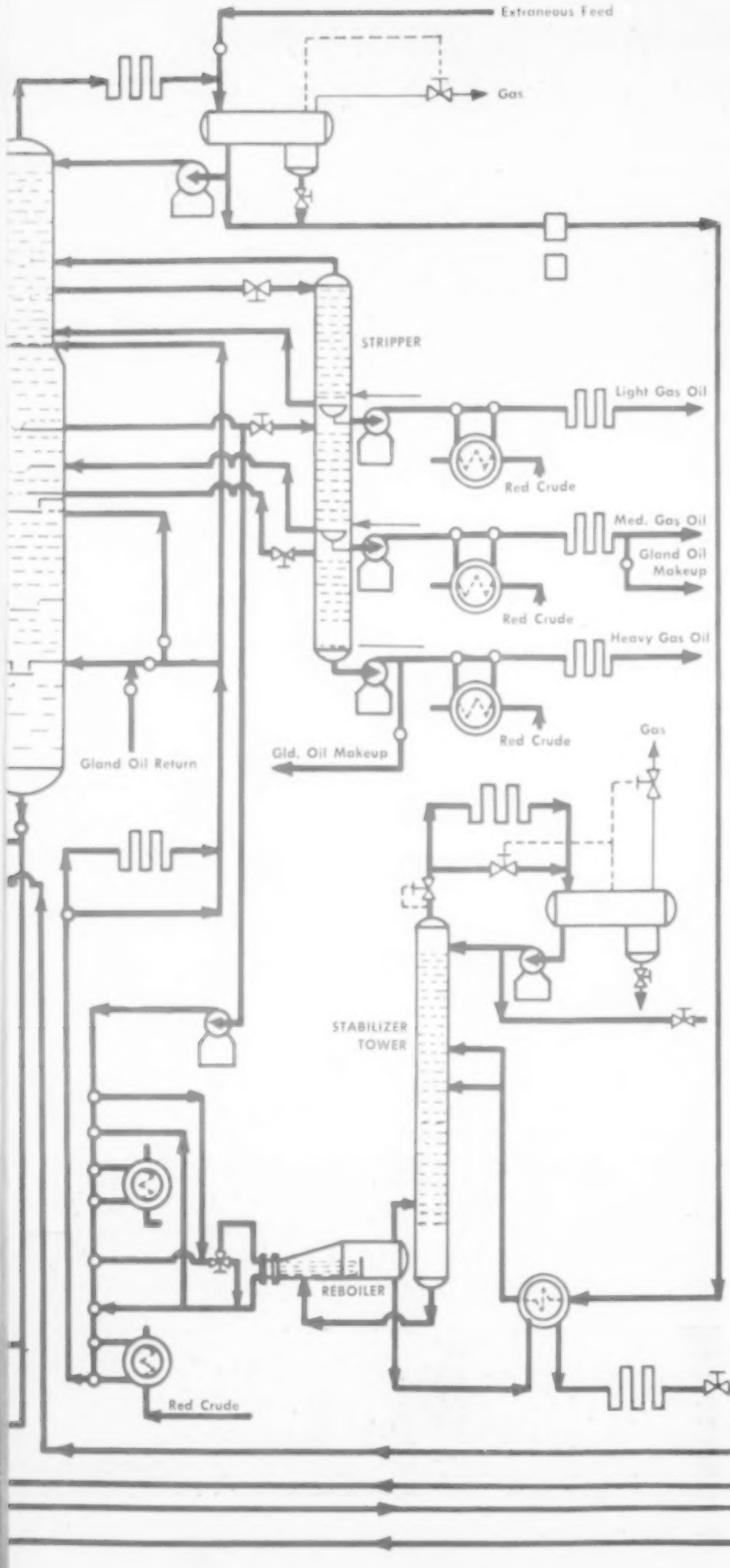
2 Charge from tower (right) bottom goes to furnaces (left). Vapor and liquid from furnaces enter coke drums (center)

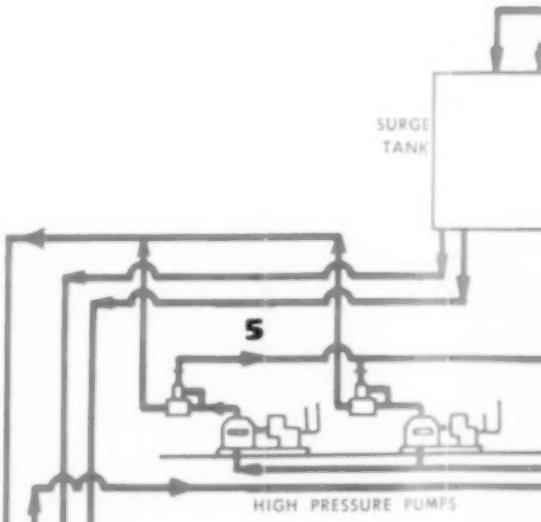



Reduced Crude
1
Light Gas Oil
Med. Gas Oil
Interm. Reflux
Heavy Gas Oil
Water
Steam
FURNACE
2
COKE DRUMS
2
BUBBLE TOWER
2
STRIPPE
Steam
Gland Oil Return
Gld. Oil Makeup
Water
Steam
FURNACE
COKE DRUMS
3
4
STABILIZER TOWER
REBOILER
Red Crude



3 Coke in the drums is removed with the aid of a hydraulic cutting tool

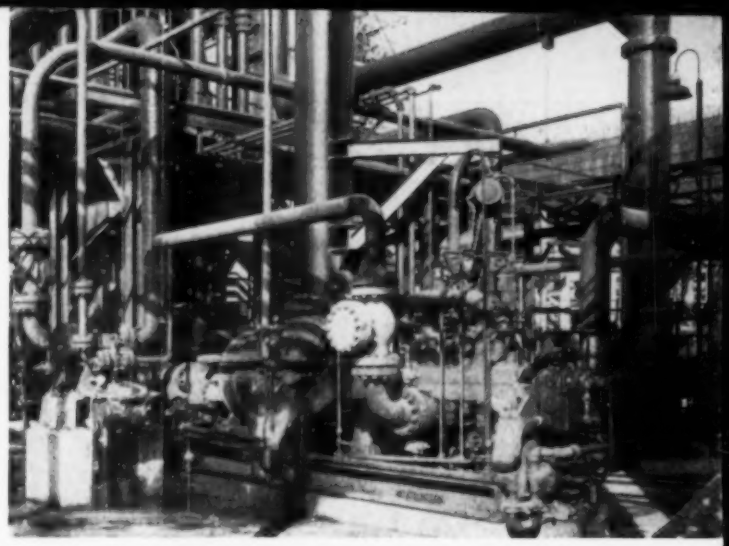




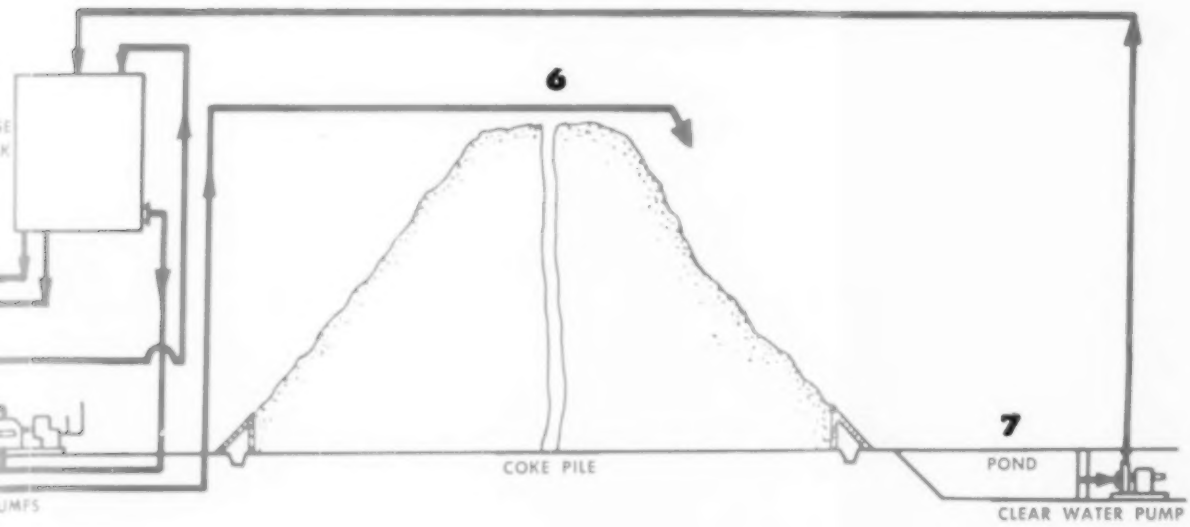
6 Coke-water slurry discharges from pip
crane is used to move coke from pile to

with the

4 Coke is cut from top of bed in coke drum and falls through hole to crusher car

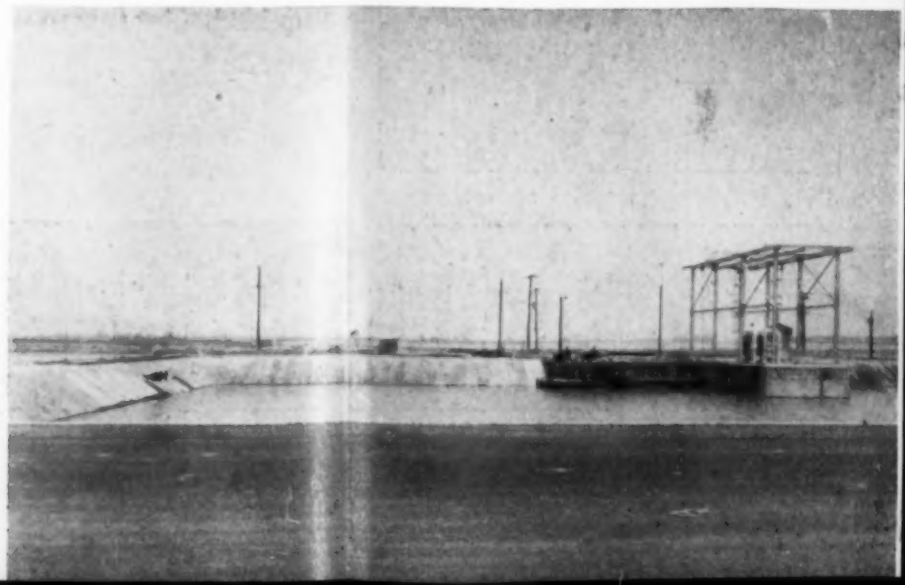


5 Coke and water are separated. Jet water pumps and turbine showing at left automatic bypass valve



arges from pipe line onto storage pile. Loading from pile to hauling trucks

7 West half of water storage basin shows the overflows from the west settling basin as well as the return pumps



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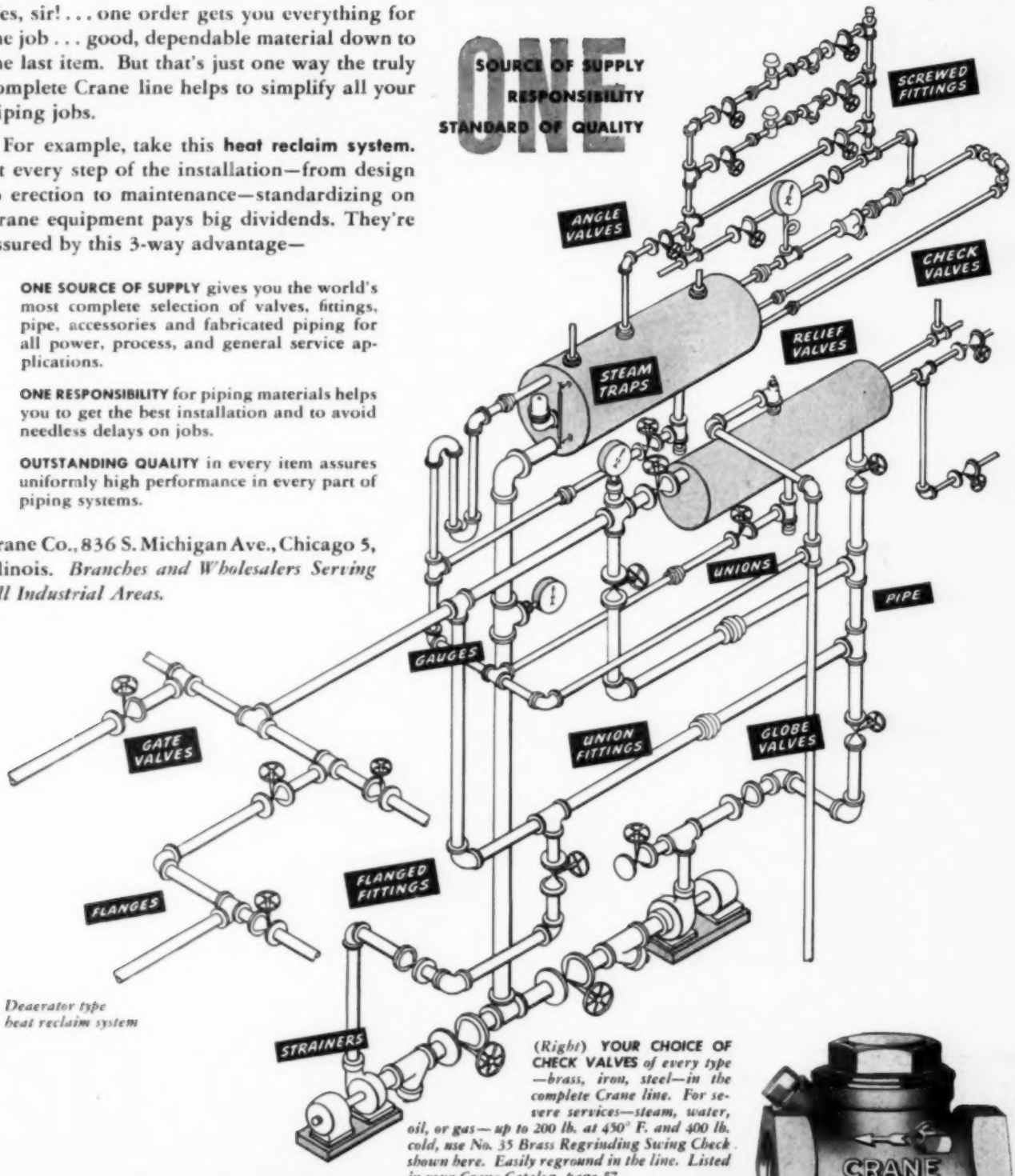

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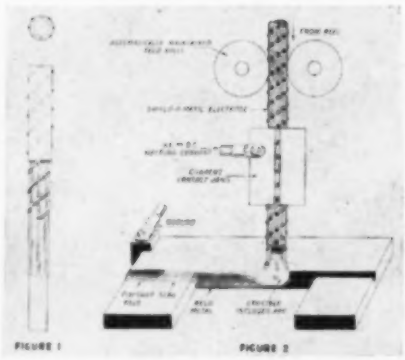
PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

AUTOMATIC ELECTRODE

WHAT is claimed to be a revolutionary advance in automatic electric arc welding is the Shield-O-Matic process introduced by Hollup Corp., a division of National Cylinder Gas Co., 218 East Ontario St., Chicago 11, Ill. The new process makes use of a new type coated electrode which is produced in continuous lengths for use in automatic welding machinery This electrode is claimed to combine all the advantages of the manual shielded-arc welding process, with the requirements for continuous automatic welding. As in the former, the new electrode incloses the welding arc in a crucible-like sheath produced by a heavy flux coating on the wire core, but special means are provided for making electrical contact through the flux from the core to the current contact jaws of the machine.

The construction of the electrode is indicated in the accompanying illustration. In Fig. 1, it is evident that a metallic grid construction binds the flux coating to the wire core, enabling the electrode to stand extreme flexing and bending without loss of flux, but at the same time forming a path for the welding current. The fin-ridge construction of the electrode core also provides for the conduction of unusually high welding current. The design is said to cause the electrode and base metal to melt at a much faster rate than conventionally, thus permitting greater automatic welding speeds. Fig. 2 shows in diagrammatic form



Automatic welding electrode and method of use

how the electrode is fed automatically and how the welding current is conducted to it. The drawing also shows the crucible-like action of the flux coating where it surrounds the arc and protects the depositing metal from the action of oxygen and nitrogen in the atmosphere. Having served its crucible function, the flux, of course, melts and forms a slag over the finished weld, as in manual shielded-arc welding.

The new method is claimed to yield welds of unusually high strength and ductility, of exceptionally uniform quality. The weld metal is claimed to be finer in grain than produced by former automatic welding methods and the actual heat input less, resulting in reduced residual stresses and distortion. The process is said to be suitable for both light gage and heavy plate welding for both low and medium carbon steels as well as low alloy high-strength steels.

Sky-Lift electric truck

HYDRAULIC FORK TRUCK

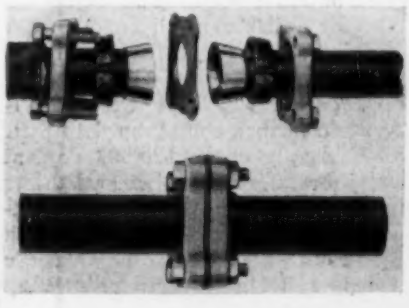
DESPITE its standard collapsed height of 83 in., enabling it to pass through a 7 ft. doorway, the improved Sky-Lift hydraulic-lift electric fork truck recently introduced by Automatic Transportation Co., 149 West 87th St., Chicago 20, Ill., is able to lift pallets to a height of 130 in. above the floor. Thus, with the same machine, it is possible to tier to ceiling heights in box cars and low clearance buildings, as well as to extreme heights where headroom is available. The design emphasizes simplicity of control, paralleling the types of controls used on an automobile as far as possible. A new control of pneumatic type, operating as the electric counterpart of an automobile gearshift, is employed to start and accelerate the truck in forward or reverse direction. The brake pedal and foot accelerator are both identical with those on an automobile and two additional levers, one controlling both lift and tilt and the other forward and reverse direction, are similar to the steering column gearshift of newer cars. In addition to its new high-pressure hydraulic system, the Sky-Lift includes other special features such as silicone varnish insulation of the electrical system, a newly-developed disk-type traction brake, special flow control valves in the hydraulic system and full "deadman" control.

STAINLESS TUBE FITTINGS

ANNOUNCED by Tri-Clover Machine Co., Kenosha, Wis., a new type of industrial flange-type conical end fitting, fabricated from Type 316 stainless steel, has been developed for use with light-gage stainless steel tubing. These fittings encompass a complete line including ells, tees, crosses, return bends, Y's, laterals, ferrules, reducers and adapters. They are suitable for use with commercial tolerance stainless steel tubing having outside diameters from 1 to 4 in. All of these fittings can be readily adapted to a variety of other fitting and valve types, including conical glass tubing, iron-pipe-size fittings, and welding fittings.

For use with the new conical end fittings is a new flanged coupling, available in both aluminum and stainless steel, and built to withstand working pressures up to 250 psi. As shown in the accompanying illustration, this

Flanged coupling for conical end fittings



coupling makes use of simple gaskets between the conical end fittings and the flange itself to produce a joint which is said to be completely tight under either pressure or vacuum.

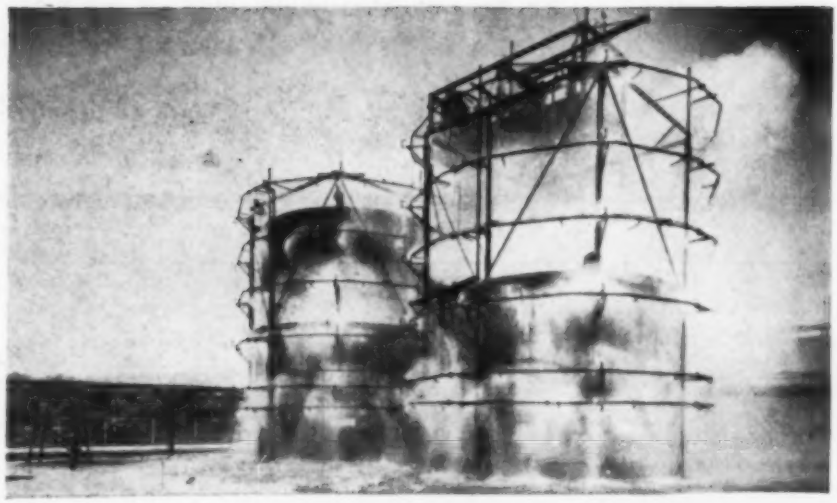
FLY ASH COLLECTOR

DESIGNED to collect cinders, fly ash and dust, as well as to quench sparks and flame, a new collector designed primarily for foundry cupolas, but also suitable for electric furnaces and stacks of various kinds, has been announced by C. C. Hermann & Associates, 5731 Somerset Drive, Detroit 24, Mich. This device is essentially a water-cooled cap constructed concentric with a steel shell which is open at the top and adapted to fit over the top of the stack. Water under low pressure is pumped to the unit through pipe connections at the lower periphery of a water-cooled cone arranged centrally within the upper, open portion of the collector. The water flows upward through a jacket on the cone and gushes out of a circular opening at the cone apex. Curved vanes secured to the top plate of the jacket then serve to distribute the water evenly over the entire top surface of the cone, keeping this surface clean. The water then flows over the edge of the outer periphery of the cone, forming an effective water curtain through which gases from the stack must pass. This water is collected in an annular launder around the upper end of the stack proper, together with sludge which is removed from the gases by the water.

The equipment has no nozzles or other mechanical devices for distributing the water, requiring only a pump or other source of water pressure at approximately 40 lb. About 75 gal. per min. is required.

PRESSURE BLOWER

Two NEW groups of axial-flow, direct-driven pressure blowers, designated as Series 16 and Series 24, have been announced by the Moore Co., 544 Westport Road, Kansas City 2, Mo. These blowers are available in a variety of corrosion resisting constructions, including Monel, stainless steel or aluminum. The Series 16 type is available in diameters from 36 to 60 in., for delivering up to 40,000 cfm. of air at static pressures up to 4 in. wg. The Series 24 is available in diameters from 4 to 8 ft. for delivering up to 100,000 cfm. at static pressures up to 4 in. wg. The design employs a weather-proof, non-overloading, direct-drive motor with the rotor carried on permanently sealed ball bearings requiring no maintenance. Motors are provided in speeds from 300 r.p.m. to 1,800 r.p.m., and horsepowers from 1 to 60. Motor ventilation is afforded by ventilating air from outside the air stream. Motor mounts are of synthetic rubber to reduce motor sound.



Butadiene Storage System

These views show a new storage and fire protection system for butadiene recently installed at a cost of about one-half million dollars at the Goodyear-operated synthetic rubber plant of Rubber Reserve Corp. at Akron, Ohio. This installation, produced through the collaboration of the Automatic Sprinkler Co. of America (designers of the equipment), Goodyear technicians, the National Board of Fire Underwriters, and the Factory Insurance Association, was financed by the Rubber Reserve. The system employs storage facilities which are submerged under water, together with butadiene pipelines passing through a series of canals. The entire system extends over nearly three acres. For gaseous butadiene which is contained within water-sealed gas holders, similar protection is used. The protection method is to employ numerous waterfog nozzles coupled with a gas-leak and fire-detecting system of extreme sensitivity. This set-up is entirely automatic and is designed to operate its 15 individual waterfog systems simultaneously, or in series.

The fire detecting circuit employs numerous heat actuator devices which react instantly with any increase in temperature. In addition, a fully automatic gas detecting unit constantly samples the air in the storage area and when any concentration of butadiene **above 60 percent of its lower explosive limit is detected, sounds an alarm, indicates the** leak location by flasher lights and, if gas concentration rises higher, ignites the vapor by an automatic spark so as to affect the heat actuators and release the waterfog units. The system is capable of applying water at rates up to 5,000 g.p.m. in a completely enveloping fog of fine water droplets.

OUTDOOR MOTORS

A COMPLETE line of outdoor, weather-proof, totally-inclosed motors in the larger sizes ranging up to and above 2,000 hp. is now being produced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The principal change in these motors in the larger ratings is a complete redesign of the ventilation-heat transfer system. All air passages are said to be practically self-cleaning and pockets in which water or other liquids might be trapped have been eliminated. The air passage tubes are designed for easy cleaning with a brush or with an air

For that IMPORTANT PROCESSING STEP

Pfaudler GLASS-LINED PILOT-PLANT KETTLES

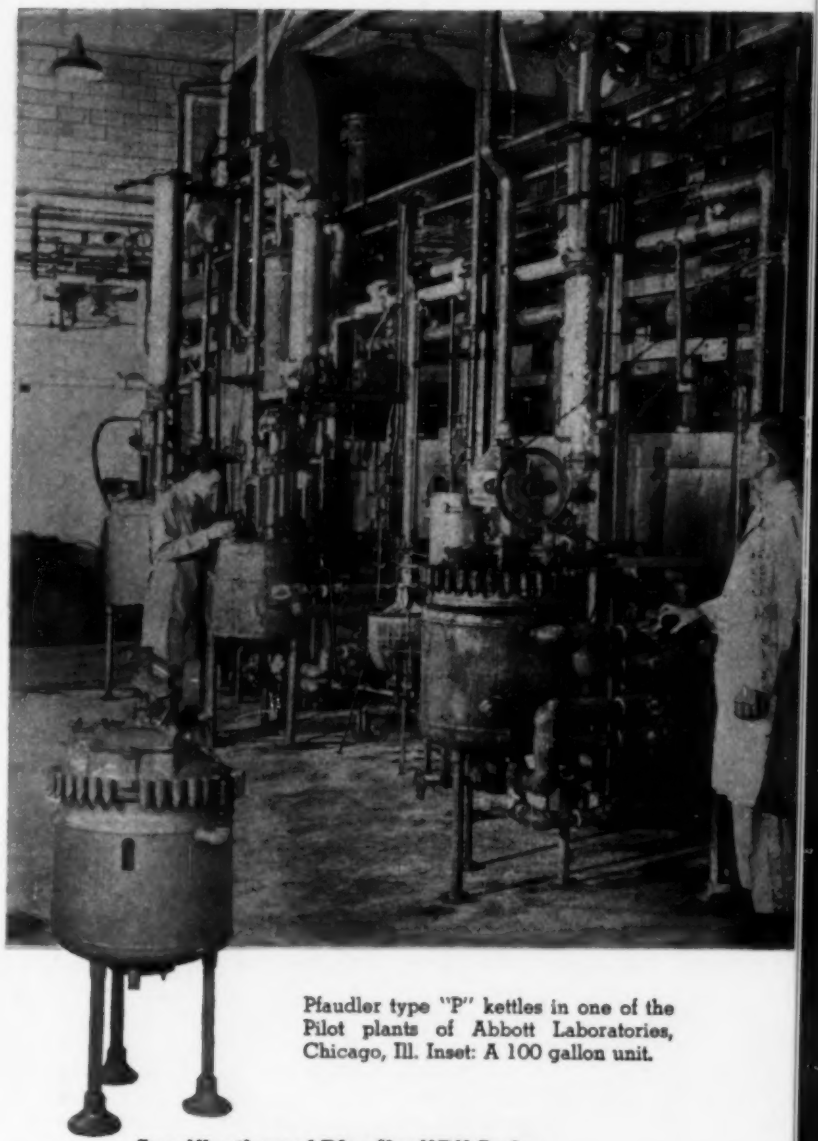
MAXIMUM PROCESSING FLEXIBILITY

- *Resistant to all acids, except HF.
- *Six standard sizes—5 to 100 gals.
- *Jacketed construction.
- *Top-heads, agitators and drives optional.

The completeness of Pfaudler's line of standard glass-lined pilot-plant kettles permits a selection which enables you to predict the behavior of processes on a plant scale. They duplicate larger equipment so that yields obtained on a pilot-plant basis can be accurately projected.

Resistant to acid attack, "P" Series kettles provide great chemical flexibility. Reactions involving neutral as well as acid reagents may be handled as desired. Easy to clean, they may be switched from one process to another, time after time.

Mechanical flexibility is another feature of this equipment since any unit may be used with or without top-head, agitator and drive. Top-heads are provided with handhole, agitator opening and ample product openings. Two types of agitators are available—the glass covered anchor type and the two blade impeller. The latter may be used with or without adjustable baffle, depending on the type of mixing action desired. Gas absorption, suspensions and emulsions are handled efficiently with the use of baffles.



Pfaudler type "P" kettles in one of the Pilot plants of Abbott Laboratories, Chicago, Ill. Inset: A 100 gallon unit.

Specifications of Pfaudler "P" Series

Rated Cap. Gals.	*Actual Cap. Gals.*	*Max. Internal Pressure Lbs. Per Sq. In.*	*Max. Jacket Pressure Lbs. Per Sq. In.*	*Jacket Heating Surface Sq. Ft.*
5	5	30	110*	3.5
10	10	25	95*	5.4
20	20	35	100*	8.4
30	32	30	90*	11.7
50	53	25	75*	16.4
100	116	25	75*	26.9

*Jacket pressures coincident with internal vacuum must be reduced 15 lbs. from those listed. Higher pressures available as special units.

THE PFAUDLER CO., Rochester 4, New York. Branch Offices: 330 West 42nd St., New York 18, N. Y., 111 W. Washington St., Chicago 2, Ill.; 1325 Howard St., San Francisco 3, Calif.; 818 Olive St., St. Louis 1, Mo.; 7310 Woodward Ave., Detroit 2, Mich.; 1318 1st Nat'l Bank Building, Cincinnati 2, O.; 1041 Commercial Trs. Building, Philadelphia 2, Pa.; 751 Little Building, Boston 16, Mass.; Box 982, Chattanooga 1, Tenn.; Enamelled Metal Products Corp., Ltd., Artillery House, Artillery Row, London, S.W. 1, England.

Pfaudler

THE PFAUDLER CO., ROCHESTER 4, NEW YORK

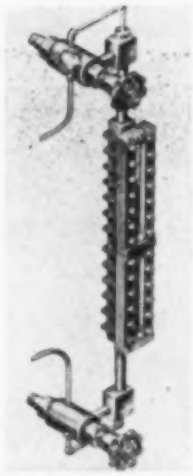
ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal

or water hose. These motors are of all-fabricated steel construction and are designed primarily for large draft fans and chemical industry use. With their waterproof joints and new cooling systems, they are expected to be as effective as cast iron motors.

HEATED GAGE

TO PREVENT liquid level gaging operations from encountering trouble with liquids which must be heated or cooled in the level gage itself, Jerguson Gage & Valve Co., Somerville 45, Mass., has developed gage columns of both the reflex and transparent types having a separate tube arranged concentrically with the gage, through which either a heating or cooling medium can be passed. The construction is evident from the accompanying illustration which shows also how the gage valves are jacketed to permit their being heated or cooled with the same medium that passes through the gage proper. According to the manufacturer, gages and valves of this type find frequent application in process plants where the liquid in the gage may be too sluggish for proper reading or where, because of low boiling point, it would tend to boil and thus cause incorrect reading. In addition, the gage is useful in cold climates where the liquid in a standard gage might freeze. Such gages are produced in a full range of sizes for pressures as high as 3,200 psi. and for temperatures as high as 1,000 deg. F.

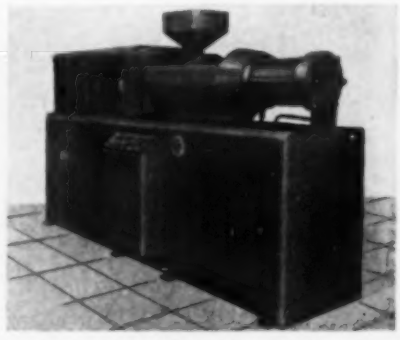


Reflex type heated gage

Hydro-Matic self-sealing test plug

Welder for thermoplastics

Flexible metallic packing



2-oz. injection molding machine

METALLIC PACKING

FOR TEMPERATURES not exceeding 450 deg. F., and for steam and air rods, centrifugal pump shafts, valve stems and expansion joints, the Asbestos Textile and Packing Division of Raybestos-Manhattan, Inc., Manheim, Pa., has developed the new No. 920 type of flexible metallic packing which is suitable where surface speeds do not exceed 600 ft. per minute. The new packing is resilient, incorporating a cross-sectional composition of nonfrictional metallic foil, combined with asbestos yarn. High-temperature-resistant lubricants and flake graphite are used for sealing effect and reducing frictional wear. The compressible characteristic is said to result in a packing sensitive to gland adjustment.

SEALING PLUG

A RAPID sealing device for closing openings in pressure vessels before they are to be subjected to hydrostatic or air testing has been announced by Mechanical Products Corp., 168 North Ogden Ave., Chicago 7, Ill. This device, which is known as the "Hydro-Matic" test plug, is self-sealing, being operated by the pressure within the tank. It is designed so that it may be inserted or removed within one or two seconds, according to the manufacturer. The effective pressure area within the cylinder shown in the accompanying illustration is greater than the area of tank opening so that the tank pressure forces the flexible sealing element against its seat with sufficient force to insure a leak-proof seal. These test plugs are designed to fit any standard opening from ¼ to 2 in. I.P.S. and are suitable for testing pressures up to 500 psi.

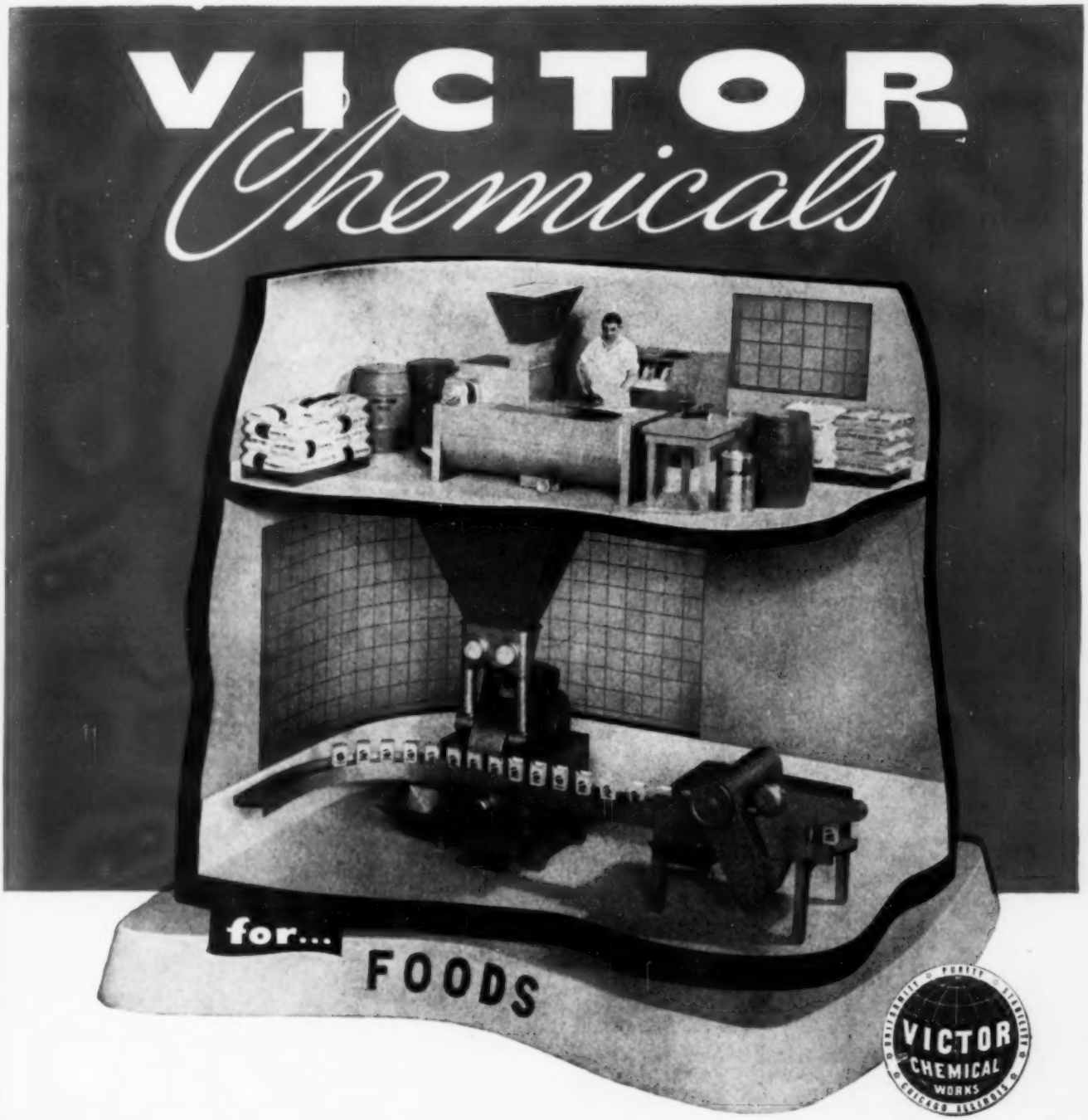
INJECTION MOLDER

WHAT is described as its first production under its own name in the plastics field is a new 2-oz. injection molding machine, designed by Warren Gross, and introduced by Hydraulic Machinery, Inc., Dearborn, Mich. The new machine, built with a 50 percent overload capacity to enable it to handle a wide range of small plastic parts, is equipped with two electronic controls to regulate the heat in the chamber and nozzle indefinitely, without danger of burning the material. A new type electronic control mounted on the machine panel is said to guarantee an accuracy of plus or minus 2 deg. Means for handling mold clamping, platens, metering of material, timing and other factors have all been designed in such a way, it is claimed, as to produce a machine which can be operated successfully by people with little or no experience in the plastics field.

THERMOPLASTICS WELDER

TYPE K3S is the designation of a new 2½-kw. Thermatron dielectric heat sealer for sealing, bonding or welding thermoplastic sheets that has been introduced by the Thermatron Division of the Radio Receptor Co., 251 West 19th St., New York 11, N. Y. The device eliminates thread-stitched seams, produces airtight, water-tight seams stronger than the thermoplastic sheets themselves, and may be used on a wide variety of thermoplastics such as Vinylite, Koroseal, Saran, Velon, and others. The 2½-kw. dielectric unit may be provided with several standard types of sealing press mounted on the unit and operated by foot controls. A wide range of seams of various lengths can be handled. Sheet thicknesses from 0.002 to 0.040 in. can be handled. Features of the device include special air-cooled tubes, oversize casters, safety interlocks, and simplified controls. The same type of power unit may be provided with a special oven

VICTOR *Chemicals*



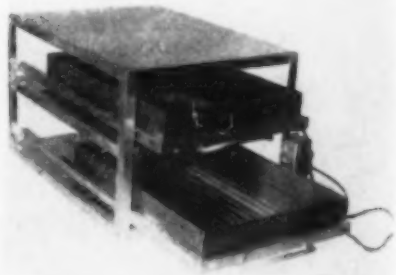
Victor Phosphates play important and varied roles in the manufacture and enrichment of food products. Cereals, flour, prepared mixes, and food beverages, for example, are enriched with essential calcium, phosphorus, and iron by the addition of Victor Calcium and Iron Phosphates. Calcium phosphates also provide the necessary leavening acid in prepared flour mixes. Disodium phosphate serves as an emulsifier in the production of process cheese and condensed milk. ¶ Victor chemicals employed in the food industry include: **Ammonium Phosphates** (yeast, vinegar, yeast food), **Dicalcium Phosphate** (mineral fortification), **Disodium Phosphate** (process cheese, condensed milk), **Hicalcium Phosphate** (calcium-enriched flour and bread), **Iron Phosphates** (mineral enrichment), **Monocalcium Phosphate** (mineral supplement, leavening acid, baking powder), **Phosphoric Acid** (yeast, sugar, soft drinks, imitation jellies, gelatine), **Sodium Acid Pyrophosphate** (acid ingredient in commercial baking powders, prepared doughnut and cake flours), **Tricalcium Phosphate** (conditioning salt, soda, and powdered sugar).

VICTOR CHEMICAL WORKS, 141 W. Jackson Blvd., Chicago 4, Ill.
NEW YORK • KANSAS CITY • ST. LOUIS • NASHVILLE • GREENSBORO, N. C.
Plants: NASHVILLE • MT. PLEASANT, TENN. • CHICAGO HEIGHTS, ILL. • VICTOR, FLA.

for heating plastic preforms, plywood, rubber, or other materials susceptible to dielectric heating.

INFRA-RED PREHEATER

FOR PRODUCING thermostatically controlled low temperatures up to 380 deg. F. for low-temperature drying applications, preheating plastic preforms, and drying paints and metal finishes, Delt-Calesco Co., Far Hills, N. J., is offering a new infra-red preheater which is built in the form of



Infra-red preheater for low temperature

an open framework containing drawers which are separately removable from two sides. The bottoms of these drawers consist of aluminum-carbon alloy heating elements, fused in tempered glass, which are said to produce an even over-all plate temperature. Materials may be placed above or below a plate, or rest directly on its surface. The unit is designed to allow ready escape of released moisture.

RADIOACTIVITY PROBE

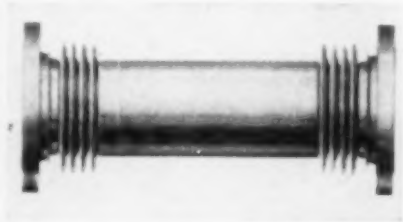
FOR GENERAL radioactivity surveys, Instrument Development Laboratories, 817 East 55th St., Chicago 15, Ill., has developed a portable beta-gamma count-rate meter which is said to be useful in locating radioactive health hazards or in finding stray radioactive materials. The meter has

Beta-gamma radioactivity probe

three ranges, 0.2, 2.0, and 20 milliroentgens per hour full scale. A detachable probe on a 4-ft. cable is used for holding the Geiger-Mueller tube. The device readily explores locations not accessible to larger instruments. To distinguish between beta and gamma rays, an adjustable shield on the probe can be set to prevent beta particles from affecting the tube. The instrument is portable and battery-operated, with the battery giving an average operating life of 500 hr. in normal use.

EXPANSION JOINT

ADDING to its various series of packless expansion joints, MagniLastic Division of Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill., has



Offset expansion joint

announced a standard line of offset joints for joining pipes that are out of line, due either to accumulated excess tolerances in piping sections, to settling and shifting, to thermal expansion and contraction, or to variations in operating conditions. The new joint avoids possible stresses which might otherwise result from the attempt to bring misaligned pipes together. As shown in the accompanying illustration, the joint is constructed with an equal number of expansion flanges on either end of an insert section. The length of unit and number of bellows flanges are determined by the conditions to be corrected. Joints are available for pipe sizes from ½ to 24 in., for pressures from vacuum to 1,000 psi.

INCLINED CONVEYOR

FOR ELEVATING and lowering commodities between floors, Standard Conveyor Co., North St. Paul 9, Minn., has introduced the standardized In-

Floor-to-floor belt conveyor

clincbelt conveyor. A rough-surface belt is furnished for the conveyor which is permanently set at 28 deg. Two belt widths are available: 14 in. for commodities up to 15½ in. wide; and 24 in. for commodities up to 25½ in. wide. Both widths are made in lengths suitable for floor-to-floor elevations of 8 to 14½ ft. inclusive. The machines can be furnished with or without the horizontal feed section at the bottom shown in the accompanying illustration. The top end is curved like a gooseneck to provide for horizontal feed or discharge.

SIGHT FITTINGS

A NEW DESIGN of sight-glass fitting for pipelines, known as Series 4000, has been announced by Jacoby-Tarbox Corp., 205 East 42nd St., New York 17, N. Y. These compact fittings,

Sight-glass fittings for pipelines

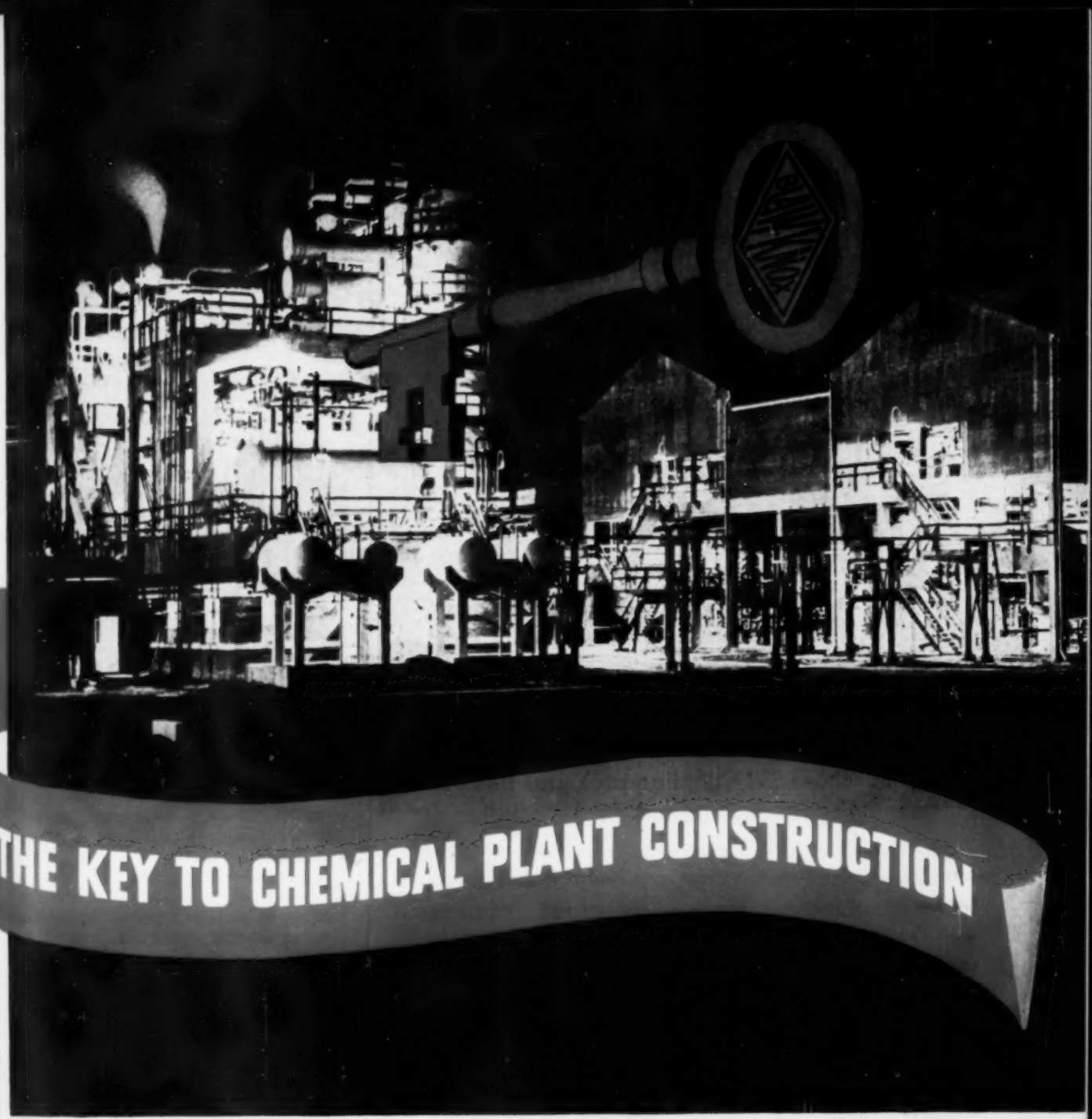
which permit the operator to know what goes on inside his pipeline, are produced in sizes ranging from ¼ to 1 in. I.P.S. They are available for iron, brass or stainless steel lines and are designed for safe operating pressures up to 200 psi. Pyrex glass is used in all standard fittings.

REMOTE SERVO

A NEW servomechanism for remote indication or control has been announced by G. C. Wilson & Co., 2 North Passaic Ave., Chatham, N. J. This device consists of three units which are shown in the accompanying

Remote control servomechanism

illustration. In the illustration, from left to right, they are: (*a*) the torque unit, (*b*) the amplifier unit, and (*c*) the control unit. The position of the shaft on the torque unit is controlled by the amplifier to correspond to the control unit. The system is said to be sensitive to 1 percent changes in the control unit, the latter requiring about 1 oz.-in. of torque for operation. The torque unit, however, develops a maximum of 50 lb.-ft. of torque. A safety



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BLAW-KNOX

CHEMICAL PLANTS DIVISION
OF BLAW-KNOX COMPANY
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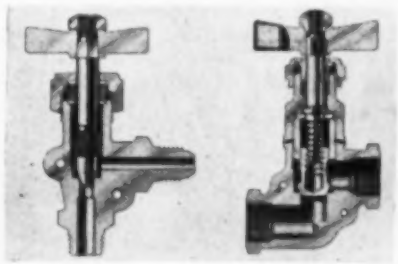
PITTSBURGH 13, PA.

feature in the form of a signal light associated with the control unit is provided to indicate correct functioning of the system, which operates on 115-volt, 60-cycle power, supplied to the amplifier.

INDUSTRIAL VALVES

A LINE of valves for industrial use, produced in pipe sizes from ⅛ to 1 in. and in tubing sizes from ¼ to 1 in., including both needle and globe types in both angle and offset designs, has been introduced by Parker Appliance



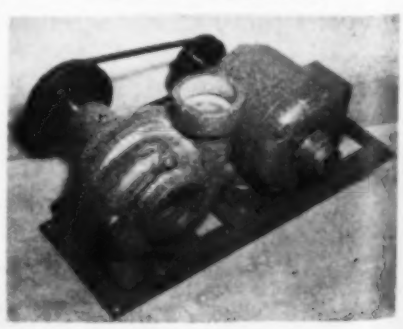
Industrial valves in needle and globe types

Co., 17325 Euclid Ave., Cleveland, Ohio. These valves are said to be unusually small and compact by reason of having forged brass bodies. Both the needle and the shut-off types are produced in six variations of connection arrangements. The straight-line types are made with female pipe threads, or tubing threads for use with flexible tubing. The angle types are provided with female pipe threads, with tubing threads, or with male pipe threads at the inlet, and either tubing or female pipe threads at the side outlet. The variations permit the valves to be directly connected into either pipe or flexible tube systems without the necessity for extra nipples, adapters, and the like.

PEDESTAL PUMP

TO MEET the needs of a wide range of users who require a pump of moderate capacity, the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has developed a line of Pedrifugal pumps which are cast-iron, bronze-fitted, pedestal-type centrifugals produced in 1-, 2- and 3-in. sizes. The capacity of the pumps range from 10 to 500 g.p.m. with

Belt-driven centrifugal pump



heads from 10 to 100 ft., and power requirements from ¼ to 15 hp. Pump and motor are mounted on a fabricated steel base, employing a V-belt drive to permit a range of capacities regulated by size of sheaves and power supply. The pumps are compact, operate in any position and can handle material containing a considerable volume of solid matter. Shaft leakage is prevented by means of a mechanical seal rather than by the use of conventional packing rings. Pumps can be supplied alone or with base and motor.

EQUIPMENT BRIEFS

CAPACITIES from 2,000 to 8,000 lb. per hour can be handled by the new No. 8 Mikro-Atomizer, a machine for grinding in the size range of 1 to 25 microns, which is produced by Pulverizing Machinery Co., 55 Chatham Road, Summit, N. J. This new machine has approximately four times the capacity of the company's No. 6 model which was introduced about two years ago and was previously described in this magazine. It employs a 75-hp. motor and without cyclone or piping occupies a space about 8x7x5½ ft.

PRESSURES from 29 in. vacuum up to several hundred pounds can be handled with a new double-impeller rotary pump introduced by Thomson Pump & Equipment Co., 717 West 11th St., Los Angeles 15, Calif. In this pump the two impellers operate at slow speed without churning action, while the internal pumping chambers are large, to permit handling liquids that contain foreign matter or solids. A variety of construction materials including iron, nickel alloy and stainless steel may be used.

DESIGNATED as Hardweld 50 A.C. and 100 A.C., a new line of high-carbon electrodes for building up worn steel parts by welding with low-voltage a.c. transformers (as well as d.c.) has been announced by Lincoln Electric Co., Cleveland 1, Ohio. The new electrodes have a heavy extruded shielded-arc-type coating and produce flat, smooth beads and deposits that can be hot forged.

TO PERMIT a 15-to-1 adjustment range without changing parts, the pneumatic pressure and differential pressure transmitter produced by Republic Flow Meters Co., 2240 Diversey Parkway, Chicago 47, Ill., can now be furnished with an adjustable weigh beam, permitting the range of the transmitter to be changed by merely sliding the adjustable pivot along a calibrated scale to the desired setting. This beam is double, having the adjustable pivot between the two

small MANUFACTURER *makes big savings*

WITH A ST. REGIS PACKAGING SYSTEM

Small manufacturers, as well as large ones, can benefit by the economies and efficiency of a St. Regis Packaging System.

An outstanding example of how successfully the system was applied by one small manufacturer is found in the case of the Stevens Soap Corporation, of Brooklyn, N. Y. This company manufactures soap powder which is used as a general purpose cleaning agent and as an ingredient of abrasive cleaners.

Faced with the high cost of drums being used for packaging of the powder, and confronted by a shortage of labor, the Company installed a labor-saving 100-LS St. Regis packer in 1944 and switched to multiwall paper valve bags. Here are some of the immediate results:

- Container costs dropped from $14 to $2.60 a ton – a saving of 81%.
- Packaging output, although limited because of material shortages, increased from 2,500 to 6,000 lbs. per hour.
- Packaging costs went down 80%.
- Labor requirements dropped from five to three men.
- Much valuable storage space was saved by compact Multiwalls.
- Dust was eliminated from the packaging operation.

So satisfied is the Company with its St. Regis Packaging System that it has ordered and received shipment of another 100-LS packer in anticipation of increased output when shortages of ingredients are eliminated.

Mail this coupon to get the detailed picture story of how a St. Regis Packaging System helped this small manufacturer achieve economical and efficient packaging.

Left: *One man operates the St. Regis 100-LS packer.*
Right: *Conveyor takes filled bags to loading point.*

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halves. Through its use, for example, a differential transmitter having a minimum range of zero to 1.0 in. of water can be changed to any range up to zero to 15.0 in.

DESIGNATED as Type 46, a new heavy-duty spray gun, designed for the application of extremely heavy materials at high speed, is being offered by Eclipse Air Brush Co., 404 Park Ave., Newark 7, N. J. Said to require minimum air volume and pressure consistent with the job, the new gun handles roofing compounds, fibrated bitumastics, emulsified asphalts and other materials usually considered too heavy to spray.

FOR HEAVY-DUTY industrial use, the B. F. Goodrich Co., Akron, Ohio, has announced a new oil-proof industrial apron of particularly heavy construction, made of Ameripol synthetic rubber. The new apron, which is 34 x 47 in. in size, weighing 1¼ lb., supplements the light-weight Ameripol industrial apron previously made.

TO SOUND an alarm whenever predetermined industrial processing conditions, such as temperature, level or pressure, are reached, Brown Instrument Co., Philadelphia, Pa., is now providing a new signalling assembly known as Air-O-Larm. This assembly, mounted in an explosion-proof housing, is adapted to inherently dangerous processing and is capable of providing either audible or visual warnings.

AN ELECTRONIC recording, indicating and controlling tachometer, said to be especially suitable for use on rotating machinery in the process industries, has been announced by Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio. The tachometer consists of a heavy duty magneto generator, used in conjunction with one of this company's standard electronic recorders. The recorder may be placed at any convenient location in the plant and connected electrically to the generator. Generators operate under low load and are said to achieve long life and low maintenance.

PROTECTION both against flame failure and dangerously low boiler water level is afforded by the new type F18TS Fireye combustion control introduced by Combustion Control Corp., 77 Broadway, Cambridge 42, Mass. The device employs an electric eye to "see" the flame and to cut off fuel or sound an alarm with flame failure. In addition, it employs a single probe mounted parallel to the boiler water column and wired to the control unit for water level cutoff.

NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

VINYL ETHERS

PRODUCTION of a new series of vinyl ethers by the Carbide & Carbon Chemicals Corp., 30 East 42nd St., New York, N. Y., is expected to start early in 1947. These new chemicals are: vinyl ethyl ether to be available in commercial quantities; vinyl isopropyl ether to be available in pilot plant quantities; and vinyl ethylhexyl ether to be available in experimental quantities. Vinyl ethers have been considered almost laboratory curiosities in this country, although their utilization has been developed to a considerable degree in Germany. The known vinyl ethers range from vinyl methyl ether which is a gas boiling at 5 deg. C. to wax-like balsams such as the vinyl ethers of alcohols from naturally occurring waxes. While only one of the ethers, vinyl ethyl ether, will be available in commercial quantities in the near future, these compounds should find many uses when more fully investigated.

The vinyl ethers are claimed to be extremely reactive chemically, and their polymerization and hydrolysis are catalyzed by acidic materials. Since they are relatively unstable the vinyl ethers as shipped are stabilized with small percentages of high boiling alkaline materials such as triethanolamine or di-2-ethylhexylamine. The inhibitor can then be removed by simple distillation, but in doing this it must be remembered that the vinyl ethers may form peroxides. Because of their reactivity, the vinyl ethers offer interesting possibilities both in chemical synthesis and in polymerization. The polyvinyl ethers are pale yellow to light brown materials ranging from liquid to rubbery solids and wax-like balsams. Polymerization may be accomplished in either the liquid or vapor phases, using a variety of catalysts. Characteristics of the resultant polymers may be varied by changing conditions or catalysts, and by proper choice of the monomeric ethers.

The polyvinyl ethers have found applications as adhesives and plasticizers, coating and lubricants. Vinyl ether polymers may find use in plastic compositions as modifiers of vinyl resins and polystyrene. Vinyl ethyl polymers have been used as plasticizers and tackifiers for synthetic rubber, nitrocellulose and other resins and synthetics, in synthetic polishing waxes, for giving lustrous appearance to resin coatings, and for impregnating paper and textiles. Liquid polymers and vinyl ethers have been suggested for replacing oils in subsoil and submarine cables. They undergo most of the reactions typical of unsaturated compounds and unite with many compounds having active hydrogen atoms.

THERAPEUTIC CHEMICALS

RECENTLY put into commercial production by Cutter Laboratories, Berkeley, Calif., are two new therapeutic products. The first of these, known as Chemozine, is used for the treatment of anaplasmosis in cattle, and is a dye metal complex whose active ingredients consist of alcohol, crystal violet (dye), copper acetate, and lactic acid. Developed originally for the treatment of human malaria, extensive field trials in the treatment of anaplasmosis in cattle has shown favorable results. Only small doses of this agent are required for treating this serious cattle disease caused by a micro parasite which lives in and attacks the red blood cells. Chemozine is now available for this purpose.

The second new product is a substitute for morphine and is used to give relief from post-operative pains without the complications of gas pains. This material, known as Alco-Dex, is a combination of 10 percent alcohol, 5 percent dextrose, and vitamin B-complex. It is claimed to satisfactorily replace the old standby morphine. Use of the material is applied intravaneously. Using intravaneous alcohol is claimed to increase the respiratory rate and give protection against pulmonary complications. In addition to the analgesic and sedative effects, Alco-Dex is said to supply nourishment because it contains vitamins and calories. While its action is slower than that of morphine, it has been found that its effect is more prolonged and that its use practically eliminates the distension and gas pains attributable to morphine. It is not habit forming.

CONTENTS

STABILIZER FOR VINYL RESINS

MANUFACTURED by the National Lead Co., 111 Broadway, New York, N. Y., are two new chemical stabilizers for vinyl compounds. Both of these are lead compounds. The first of these two stabilizing compounds known as Tribase is basic lead sulphate. This material is a hydrous, tribasic lead sulphate which, possessing a high degree of basicity, makes its useful for applications requiring a white, highly reactive basic lead salt. Having a total lead content equivalent to 90 percent lead oxide with an available lead oxide content of 67.3 percent, Tribase is considered to have a number of good possibilities and is claimed to be an excellent stabilizer for vinyl plastics. Its white color makes it readily adaptable in a wide variety of uses where stability to light, heat and moisture is important, and where the electrical characteristics are important. Properties of Tribase are shown in the accompanying table.

Properties of Tribase

Formula	$3\,PbO.PbSO_4.H_2O$
Form	extremely fine powder
Color	white
Molecular weight	990
Specific gravity	7.1
Refractive index	2.1
Lead content (% Pb)	83.7
Lead content (% PbO)	90.1

The second of these two products known as Plumb-O-Sil is co-precipi-

tated lead orthosilicate and silica gel in the form of a soft white powder. It is a stabilizer for use with vinyl chlorides and vinylidene chloride polymers, and is particularly adaptable for use in the production of clear plastics. It is available in two forms, A and B, which differ in refractive index. Either type may be used where the application requires a stabilizer without tinting strength and one which will cause minimum impairment either to dye or other pigment additions. Properties of Plumb-O-Sil A and B are shown in the accompanying table.

Properties of Plumb-O-Sil

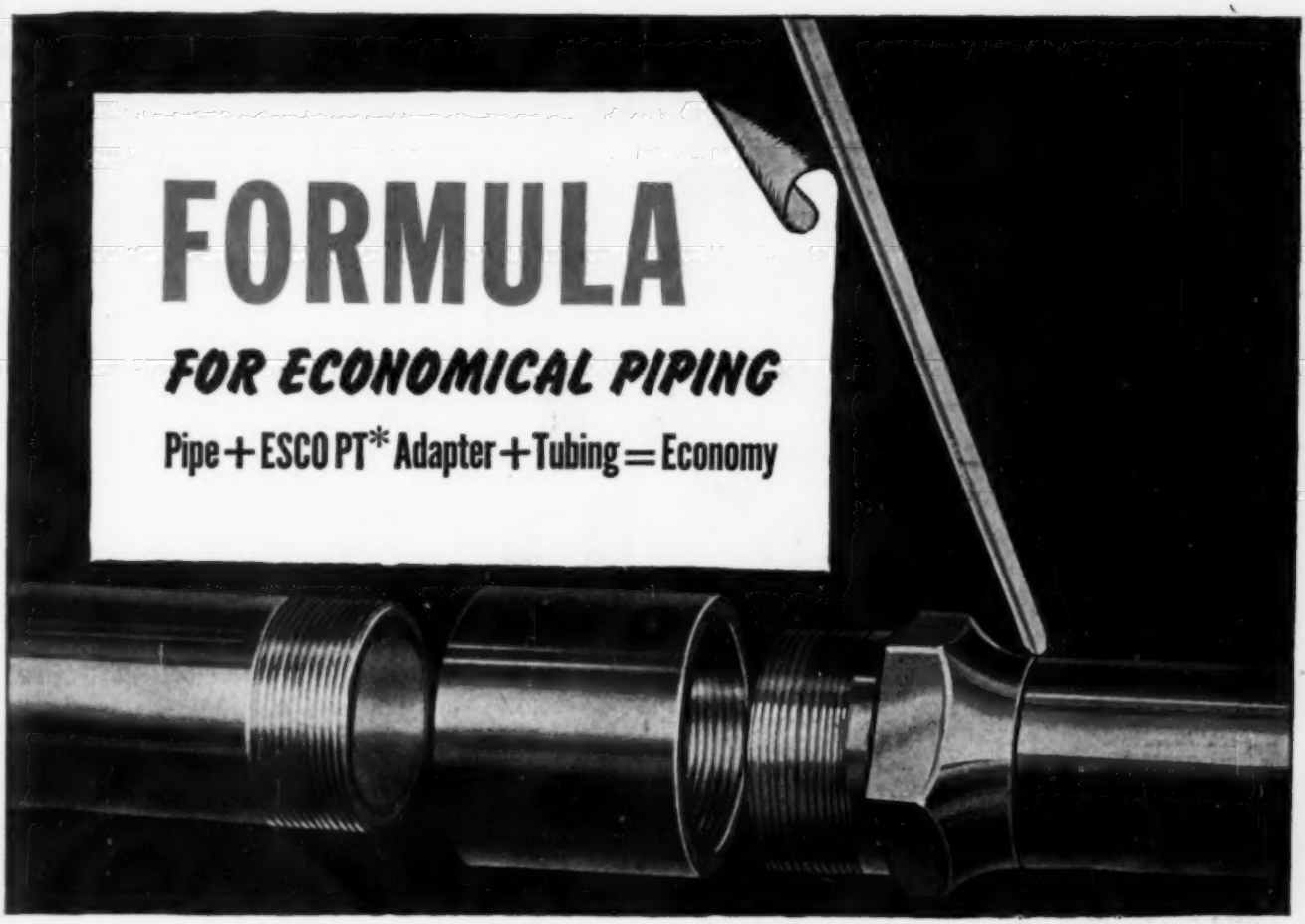
Plumb-O-Sil A	
Lead content (% PbO)	60 to 61
Silica content (% SiO_2)	39 to 40
Specific gravity	4.1
Refractive index	1.67
Plumb-O-Sil B	
Lead content (% PbO)	49 to 50
Silica content (% SiO_2)	50 to 51
Specific gravity	3.3
Refractive index	1.58—1.60

FORMALDEHYDE POLYMER

ANNOUNCED several months ago as being available in limited quantities, Trioxane is now in commercial production by the E. I. du Pont de Nemours & Co., Wilmington, Del. Trioxane is a colorless, plastic, crystalline solid with a sweet odor resembling that of chloroform. It has no trace of formaldehyde odor. It ignites instantly and burns with a very hot, non-luminous, clean, odorless flame, a property suggesting its utility as a packaged fuel for campers, picnickers, and hunters. It is readily soluble in alcohols, ketones, ethers, esters, chlorinated hydrocarbon solvents and aromatic hydrocarbons. In the molten state, Trioxane is a good solvent for many organic substances, including phenol, naphthalene, vegetable oils, fatty acid amides, urea, and other materials. Its solubility in many organic materials makes possible its use as an intermediate in organic reaction media. Small amounts of strong acids or acid-forming substances cause it to depolymerize to monomeric formaldehyde at a rate that may be readily controlled by regulating the amount of catalyst and the temperature. By this means, Trioxane added to a reaction mixture forms a system that is stable until the required catalyst is added to cause depolymerization.

DYEING AGENT

RECENTLY developed by the Dexter Chemical Corp., 819 Edgewater Road, New York, N. Y., is a new dyeing agent and detergent. Known as Clavanol, this material is a non-ionic synthetic detergent of a high molecular weight condensation product of polyethylene glycol. It is soluble in warm



The cost of your new piping system can be greatly reduced by *ESCO* PT* adapters. These make possible the joining of IPS piping and fittings to thin wall tubing, which often can be used instead of the more costly IPS piping. *ESCO* PT* adapters...

- Permit thin wall tubing to be used in combination with IPS piping and screwed fittings.
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- Moderate cost — little more than ordinary stainless nipples.
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or cold water and has good emulsifying properties. Available in the concentrated form and as a solution of the concentrate, this material is recommended for use in the dyeing of cotton and rayon. In addition to its detergent effect, Clavanol is claimed to retard the exhaustion of direct dyes from the dye bath by forming unstable aggregates with the dyestuff. In the dyeing of rayon and cotton mixtures, the addition of Clavanol to the bath tends to minimize the difference in dye affinity of the two fabrics. This material may be used with advantage in the dyeing of cotton and rayon with diazo colors as well as with acetate colors.

LOW PRESSURE MOLDING RESIN

DEVELOPED by the Goodyear Tire & Rubber Co., Akron, Ohio, a new resin known as GRM-2 can be molded at low pressures ranging from 15 to 40 lb. per sq.in. instead of pressures in the range of 100 lb. per sq.in. often used in this type of work. This material, a derivative of a complex organic glycol, can be laminated with a considerable variety of materials including paper and various fabrics such as canvas and glass fiber. A laminated plastic of glass fiber and GRM-2 showed a tensile strength of 38,000 lb. per sq.in. as compared to a tensile strength of 21,000 lb. per sq.n. for aluminum. Because the new resin can be molded at low pressure, it is possible to carry on the laminating operation with the aid of inexpensive wooden molds. The usual process is to build up layers of fabric saturated with the resin over a form. The completed fabrication is then transferred to the mold where pressure is applied with the aid of an inflatable rubber bag.

ENAMEL STRIPPER

DEVELOPED to remove synthetic enamels from all types of surfaces, including metal and wood, is a new spot enamel stripper now available from Enthone Inc., 442 Elm St., New Haven, Conn. Known as Enthone Enamel Stripper S-45, it is recommended for stripping of enamel on large parts that cannot be easily immersed in a stripping solution. This material is a slightly viscous liquid that can be brushed on, sprayed or applied by dipping to the work to be stripped. It contains a non-waxy evaporating retardent that keeps the stripper on the work until action is completed. It causes a wrinkling action so that the enamel can be brushed, wiped or scraped off. S-45 is claimed to have fast action on most synthetic enamels as well as certain nitrocellulose coatings. Modified formaldehyde, and alkyd coatings are rapidly removed. No waxy residue is left to interfere with

Just off the Press...

New reference book on Aluminum Alloys and Mill Products

FOR design engineers, production men, and purchasing agents, this new reference book brings invaluable data on aluminum.

It contains 248 pages, 106 tables, 20 photographs, chock-full of specific facts about Aluminum Alloys and Aluminum Mill Products.

The information is arranged according to type of product . . . sheet and plate; extruded shapes; roll-formed shapes; tubing and pipe; wire, rod and bar; forging stock; press forgings; ingot metal for sand casting, permanent mold casting and die casting. For each product, the book shows alloys and tempers, bend radii (for sheet), pressure calculations (for tubing), manufacturing methods, annealing and heat-treating cycles, weights, size and tolerance ranges, chemical compositions. It also covers physical and mechanical properties including densities, coefficients of expansion, thermal and electrical conductivities, yield and ultimate strengths, hardnesses and much other information.

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* Please do not send purchase orders, cash or stamps

adhesion on subsequently applied finishes. Linseed oil paint, phenol-formaldehyde enamels, or vinyl type coatings are not satisfactorily handled by this stripping agent. On recommended applications it is claimed that most enamels are thoroughly loosened in about five minutes, although some may take longer and require several applications of the stripper. The material must be handled with care since it is harmful to hands or eyes. It must be stored at temperatures lower than 100 deg. F. and is available in 1-, 5- and 53-gal. non-returnable containers.

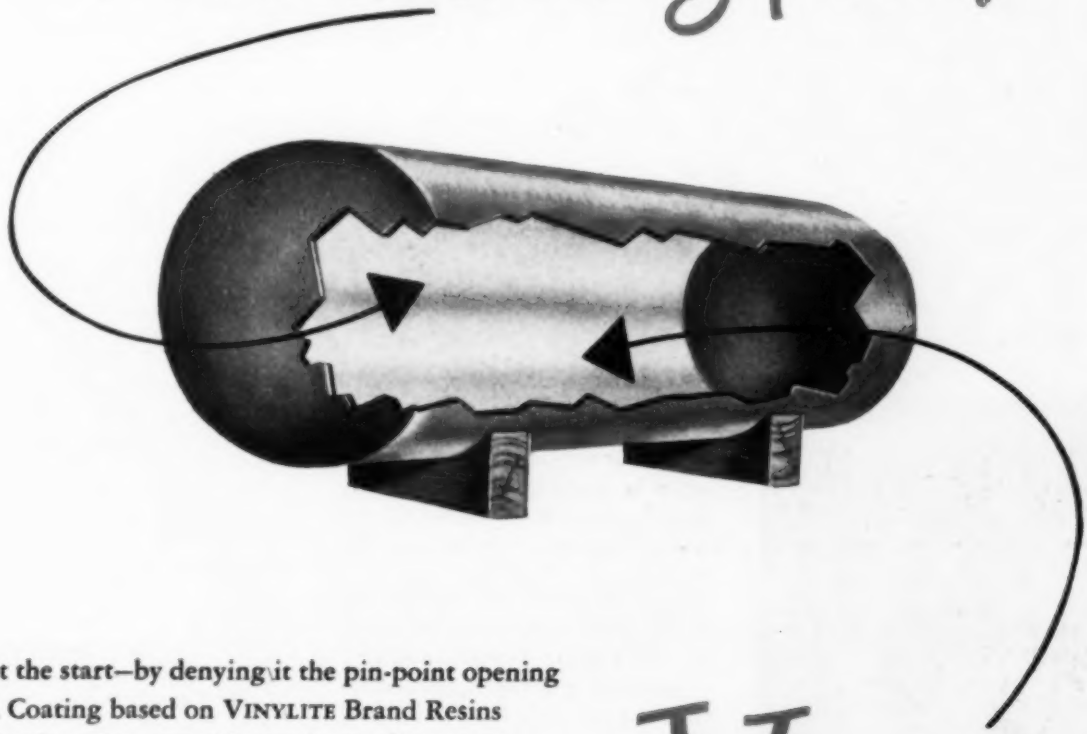
RESIN FROM PETROLEUM

RECENTLY announced by the Esso Laboratories of the Standard Oil Co. (New Jersey) 30 Rockefeller Plaza, New York 20, N. Y., is a new synthetic resin from petroleum which is said to be successfully applied as a protective coating to iron, brass, bronze, aluminum and highly polished metals in addition to wood and steel. Having the brand name of A-Resin, this material was developed to meet the specifications of the paint and varnish industry. Manufactured from crude petroleum, A-Resin is claimed to have good qualities of adhesion, flexibility and wetting power which make it useful on surfaces difficult to paint with ordinary coating materials. Tested as a baked priming coat on automobiles, it is said to be hard, durable, light-fast and chemically resistant. Steam at 15 lb. pressure and 250 deg. F. does not affect material coated with this resin. The resin is also resistant to the high acidity of grapefruit and other fruit and vegetable juices. Quick air dry films using A-Resin are said to have good light fastness and will retain a high and lasting gloss. A commercial size plant is being planned for production of A-Resin in its various types and forms.

COLORS FOR PLASTICS

ANNOUNCED by the Wilmington Chemical Corp., 10 East 40th St., New York 16, N. Y., is a group of coloring materials for use in plastics. Under the brand name of Poly-Tint Stains, these new materials are light-fast, and are selected for their compatibility with one another, purity of shade, and general stability. They are applied by dipping. The 600 Series of Poly-Tint Stains were developed for coloring cellulose acetates, cellulose acetate butyrate, ethyl cellulose, polyvinyl chloride, and other materials in the same class. The second type, the 700 Series, is used for coloring methyl methacrylate and polystyrene. Each of these two types is produced in four standard colors: red, blue, yellow and black, from which other colors may be pro-

Corrosion Cannot Start without a starting place!



STOP IT at the start—by denying it the pin-point opening it needs. A Coating based on VINYLITE Brand Resins accomplishes just that—provides an intact film, tough, resilient, non-cracking, amazingly resistant to the abrasions or surface-breaks that give corrosion the chance it seeks.

Tank interiors impose a special problem—particularly when they contain fluids that can attack steel or be contaminated by it. In such uses, VINYLITE Plastic linings work both ways—protecting tank and contents one from the other—and maintaining integrity and bond through years of hard service.

Engineers place great faith in tough linings based on VINYLITE resins—and no wonder. Again and again they have demonstrated their inherent superiority in these and similar uses—in oil well casing that plunges deep underground—in chemical processes where tanks and pipes must be kept inert as well as intact. Such coatings are resistant to strong acids, nearly all chemicals, and for short periods, to temperatures as high as 300 deg. F. Write Department BQ-46 for detailed technical data, formulations and information on suppliers of VINYLITE Plastic coatings.

Vinylite TRADE-MARK **plastics**

BAKELITE CORPORATION, ***Unit of Union Carbide and Carbon Corporation*** UCC **30 East 42nd Street, New York 17, N. Y.**

duced by blending. They are best used at a normal room temperature and should not be used above 110 deg. F.

Another material now available from this company is a group of pigment dispersions in liquid form for the coloring of latices and aqueous dispersions of natural and synthetic rubber, polyvinyl chlorides, polyvinylidine chlorides and similar materials. Known as Poly-Tint Aqueous Dispersions, these materials are highly fluid using light-fast and stable pigments. They are available in four basic colors, red, blue, yellow and black.

PHENOLIC RESIN COATING

NOW AVAILABLE to fabricators in this country through Phenoglaze Sales Corp., 315 Broadway, New York 7, N. Y., is a phenol-formaldehyde protective coating manufactured in England for use on all types of wood and metal products. Various tests have been made on this new product which is known as Phenoglaze, and it is claimed that this material is impervious to heat, moisture and chemical action such as that of salt, gasoline, oil, alcohol, turpentine, acetone and various corrosive agents. It is said to offer complete protection against termites, marine borers, cosmetics, cigarette burns and contraction and expansion caused by extremes of temperatures. This new material is applied by spray, brush, or by dipping, and is available as a clear or colored liquid. Phenoglaze is said to have high resistance to galvanic influences, to acids and alkaline solutions, has been used in the manufacture of such products as furniture, station wagon bodies, wood or steel boats, radio cabinets, etc. It is air drying and cold setting.

AGRICULTURAL CHEMICAL

A NEW agricultural spray has been announced by the B. F. Chemical Co., Rose Bldg., Cleveland, Ohio. Consisting of a mixture of Good-Rite p.e.p.s. (polyethylene polysulphide), recently announced in these columns, and zinc-dimethyl dithiocarbamate and cyclohexylamine, it is used to thin excessive and undesirable fruit and is non-injurious and non-caustic to both fruit and tree. This permits the remaining fruit to attain larger size and improved quality.

PHENYL MAGNESIUM BROMIDE

ANOTHER of the series of Grignard reagents recently announced by Arapahoe Chemicals, Inc., Boulder, Colo., is phenyl magnesium bromide. Both phenyl magnesium bromide and methyl magnesium bromide are now available for immediate delivery in drum lot quantities.

CHEMICAL ENGINEERING NEWS

DOW PURCHASE OF VELASCO STYRENE PLANT APPROVED

THE Dow Chemical Co. position as a major producer of polystyrene appears bulwarked with the purchase from the War Assets Administration of the government styrene plant at Velasco, Tex., just given final approval by the Department of Justice. These facilities, added to Dow's styrene plant here, are said to give the company a styrene capacity in excess of 200 million pounds annually. Company officials explain, however, that acquisition of the Texas property does not foreshadow an immediate increase in the volume of polystyrene which has been in short supply since the plastic was released from war materials lists. Dr. Willard H. Dow, said that while buna requirements are gradually diminishing, roughly three-fourths of the Velasco production will continue to the Rubber Reserve for an indefinite period. He added that industry is also showing much interest in new nonplastic uses for the versatile liquid, among them being laminating resins, impregnation of magnesium castings and the replacement of drying oils in paints.

In addition to the styrene plant, Dow also acquires a portion of the Velasco magnesium plant, including the lime, chlorine and power facilities. The actual metal producing units are not acquired and are to be held in standby condition by the government. Dow's bid on the property, most of which was built in 1942, was $35 million.

NORTHWEST FERROSILICON PLANT DECLARED SURPLUS

THE GOVERNMENT-owned ferrosilicon plant at Rock Island, Wash., ten miles south of Wenatchee has been declared surplus by WAA, and will be offered for sale or lease at an early date. Built during the war at a cost of $2,000,000, the plant had a design capacity of 16,200 tons of 75 or 85 percent ferrosilicon annually. The ten buildings are situated on approximately 40 acres, and plant facilities include eight reduction furnaces.

Previously, WAA rejected a bid for the sale of the plant to an undisclosed company because the bidder proposed to dismantle the plant for export. At one time WAA had also proposed the scrapping of the plant, but the proposition was dropped after vigorous protest by the Washington State Advisory Commission. One firm, according to reports, has made a survey to determine feasibility of converting the unit to the production of phosphate fertilizer.

COMMITTEES APPOINTED FOR DCAT DINNER IN MARCH

COMMITTEE appointments for the 21st Annual Dinner of the Drug, Chemical & Allied Trades Section of the New York Board of Trade, to be held Thursday, March 13, at the Waldorf-Astoria, have been completed as follows: Dr. Carle M. Bigelow, American Cyanamid Co., chairman of the section, Robert B. Magnus, Magnus, Mabee & Reynard, Inc., chairman of the dinner arrangements committee; Fred J. Stock, Chas. Pfizer & Co., Inc., vice chairman of the section and chairman of the reception committee; Lloyd I. Volchening, Ivers-Lee Co., chairman of the publicity; and Guy L. Marsters, chairman of the program committee.

EUROPE WANTS U. S. ENGINEERS AND HAS DOLLARS TO PAY

CHEMICAL engineering is one of the most prized American skills in Europe today and dollars are available in payment for such services, according to Dr. Ralph Landau of the Scientific Design Co., Inc., who has returned from an extended European tour. Conferences with British and continental chemical companies on new expansion programs convinced him that American engineering, particularly chemical engineering, is held in great esteem. An opportunity awaits American contractors and consultants who are willing to study this European market and adapt their methods to its requirements.

COMMERCIAL SOLVENTS BUYS CHEMICAL PLANT

PURCHASE by Commercial Solvents Corp. of the Pennsylvania Alcohol and Chemical Co. was revealed recently. The new unit will operate as an independent division, augmenting the manufacturing and distribution facilities of Commercial Solvents. The plant purchased is at Carlstadt, N. J.

PMMA ELECTS OFFICERS AT ANNUAL MEETING

AT ITS annual meeting, John R. Hoover of Cleveland, vice president of B. F. Goodrich Chemical Co., and Dr. D. S. Frederick of Philadelphia, vice president of Rohm & Haas Co., were elected president and vice president respectively, by the Plastic Materials Manufacturers Association, Inc. F. H. Carman was reelected general manager and John E. Walker, secretary-treasurer with headquarters in Washington. The seven-man board of directors includes: Mr. Hoover, Dr. Frederick, M. G. Milliken, Felix N. Williams, Harry Hrehbiel, C. J. Romieux, and W. Stuart Landes.

HELIUM CRYOSTAT USED FOR LOW TEMPERATURE STUDY

RESEARCH at very low temperatures will be made easier by the Collins helium cryostat, which can maintain any temperature down to that of liquid helium, −457 deg. F. Arthur D. Little, Inc., has undertaken to construct several of these newly developed instruments for industrial and institutional laboratories. In addition, the company plans to inaugurate a program of research at low temperatures, where it is possible to observe many phenomena which are obscured by the effects of heat at higher temperatures.

CALIFORNIA OFFERS COURSE IN ATOMIC ENGINEERING

RECOGNIZING an immediate need for engineers trained in the basic engineering of chain reacting piles and their application to power plants, the University of California extension at Los Angeles has inaugurated a unique course in designing and developing the various chain-reacting piles and their application as power sources for practical commercial uses. Called "Theory and Design of Chain Reacting Piles," the course is divided into two sections, one on the UCLA campus and the other at the University Extension in downtown Los Angeles. Instructor for the course is Leo H. Ohlinger, consultant in nuclear design for a southern California aircraft com-

pany, and for four years connected with the Manhattan Project at Hanford Engineer Works where he made basic designs for the plutonium plant.

CHEMICAL CAPONIZERS GET O.K. FROM FDA

ALTHOUGH viewed with understandable alarm in some quarters (see *Chem. Eng.* Jan. 1947, p. 116), the Federal Food and Drug Administration has ruled that it is all right to eat even the livers of capons produced non-surgically by the administration of the female sex hormones—dimethyl ether of diethyl stilbestrol or dianisyl hexane. General Mills worked out this chemical caponizing at its Rockford, Ohio plant where Maxwell L. Cooley is chief chemist. Other researchers, according to *Business Week*, have been "tenderizing" chickens by planting pellets of one or the other of these hormones in their necks, where they are gradually absorbed. *B.W.* reports

CONVENTION CALENDER

Technical Association of the Pulp and Paper Industry, annual meeting, Hotel Commodore, New York, N. Y., February 24-27.

American Society For Testing Materials, spring meeting, Benjamin Franklin Hotel, Philadelphia, Pa., February 24-28.

American Institute of Mining and Metallurgical Engineers, world conference on mineral resources, Waldorf-Astoria Hotel, New York, March 17-19.

American Society of Lubricating Engineers, annual meeting, William Penn Hotel, Pittsburgh, Pa. March 17-19.

American Society of Metals, western metal congress and exposition, Civic Auditorium, Oakland, Calif., March 22-27.

National Association of Corrosion Engineers, annual meeting, Palmer House, Chicago, Ill., April 7-10.

Electrochemical Society, spring congress, Brown Hotel, Louisville, Ky., April 9-12.

American Chemical Society, 111th national meeting, Atlantic City, N. J., April 14-18.

Second National Plastics Exposition, Coliseum, Chicago, Ill., May 6-10.

American Institute of Chemical Engineers, regional meeting, Coronado Hotel, St. Louis, Mo. May 11-13.

Pacific Chemical Exposition, Civic Auditorium, San Francisco, Calif. October 21-25.

Exposition of Chemical Industries, 21st exposition, Grand Central Palace, New York, N. Y., December 1-6.

Formaldehyde-Heyden

Synthetic resins made with FORMALDEHYDE-HEYDEN serves the plastics manufacturer, whether he is using Casting resins, Laminating resins or resins suitable for injection or compression molding.

Because it is consistently low in acidity, iron and copper content, and high in uniformity, FORMALDEHYDE-HEYDEN makes the finest Phenolic, Melamine and Urea Resins.

FORMALDEHYDE-HEYDEN serves also in the production of casein plastic, used largely in buttons, buckles and costume jewelry.

FORMALDEHYDE-HEYDEN is available in amounts to meet any requirement: Tank Cars and Trucks, Carboys and Drums, as well as in Bottles for small quantity users.

Further information, also Technical Data Sheets will be sent upon request.

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Chemical Corporation

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Chicago Sales Office: 180 N. Wacker Drive, Chicago 6, Ill.

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that this "makes old hens act like spring fryers. But the most successful application commercially is to make cockerels effeminate and as tender as their sisters." Thus the way has now been cleared for further advance of American living standards through this contribution of the synthetic organic chemical industry.

NAUGATUCK CHEMICAL LOCATES IN WEST

For the purpose of processing and distributing specialty aromatic chemicals used in rubber, cosmetics and soap, plastics and other products, the Naugatuck Chemical Div. of United States Rubber Co. has established manufacturing facilities and Western headquarters in Los Angeles. Plant space, obtained from RFC at the Los Angeles synthetic rubber project, has already been completely converted for the chemical operations. Investment in plant and inventories will exceed $250,000.

Initial operations will be confined to supplying rubber chemicals to fabricators on the Pacific Coast, it was stated. These products include a chain modifier for GR-S rubbers, a synthetic rubber antioxidant and stabilizing agent, and various rubber accelerators. Synthetic latex, procured from the Los Angeles synthetic rubber polymerization plants, will be processed by increasing percentage of solids from 30 to 65 percent through a creaming method.

ST. REGIS PURCHASES THREE PAPER MILLS

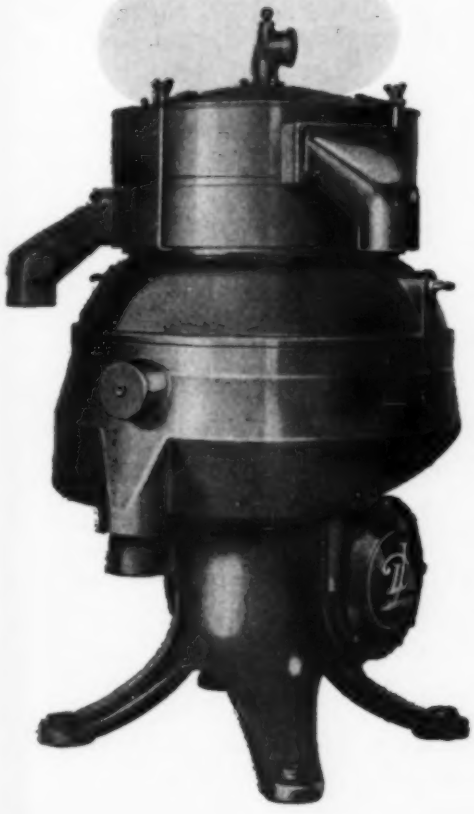
The St. Regis Paper Co., has completed the purchase of the three paper mills from Time, Inc. This transaction will add 180,000 tons to St. Regis' annual output of printing, publication and converting papers, doubling its present production of these grades. By this purchase St. Regis acquired the Maine Seaboard Paper Co., Bucksport, Me.; Hennepin Paper Co., Little Falls, Minn., and the Bryant Paper Co., Kalamazoo, Mich. The contract provides that an annual maximum of 85,000 tons of St. Regis publication paper will go under long-term contracts to Time, Inc., for the publications of its magazines.

MONSANTO BUILDS NEW WOOD FLOUR PLANT

The plastics division of the Monsanto Chemical Co. announced it has under construction a new plant for production of wood flour, ingredient of phenolic-type plastics. The new three building facility will free Monsanto from dependency on outside

IS YOUR *Separation Problem* KIN TO ANY OF THESE?

Acid Sludge • Blood • Caustic Soda • Chicle
Citrus Juices • Cooking Fat • Essential Oils
Fire Extinguisher Fluid • Fish Oil • Formaldehyde
Glue Liquor • Gluten • Irish Moss • Lacquer
Latex • Liver Oil • Olive Oil • Paint & Varnish
Penicillin • Pharmaceuticals • Printing Ink
Proteins • Serum • Starch • Streptomycin
Tomato Juice • Vegetable Oil • Wool Grease • Yeast



FROM De Laval's large line of highly specialized centrifugal machines, which includes more than a dozen distinct types and sizes, every problem of applying centrifugal force can usually be met in the most efficient, economical manner. The types and varieties of problems solved by De Laval engineers are far more comprehensive than the examples listed above but the benefits in all cases are fundamentally the same.

In addition to speeding up operations by converting a process to a continuous basis, De Laval centrifugals have two additional advantages worth noting: (1) they effect material savings and (2) generally, if not invariably, they improve the product.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

When writing, please specify whether you are most interested in separation, clarification or concentration.

De Laval Centrifugal Machines

FOR PROCESSING SYSTEMS

sources and at the same time permit control over product quality. During the past year the wood flour market has been extremely erratic with demand frequently exceeding supply. The new plant will eliminate one of several factors adversely affecting production of phenolic molding compounds. It is expected to be in production by May 1.

CASE SEEKS TO CHANGE NAME OF SCHOOL

CASE School of Applied Science, Cleveland, will become Case Institute of Technology in early 1947 provided a petition filed December 30 in Common Pleas Court by Frank A. Quail, president of the college's trustees, is approved. The court's permission is necessary since changing the name departs from the provisions of the founder's, Leanard Case, Jr., trust established in 1877. No opposition to the change is expected.

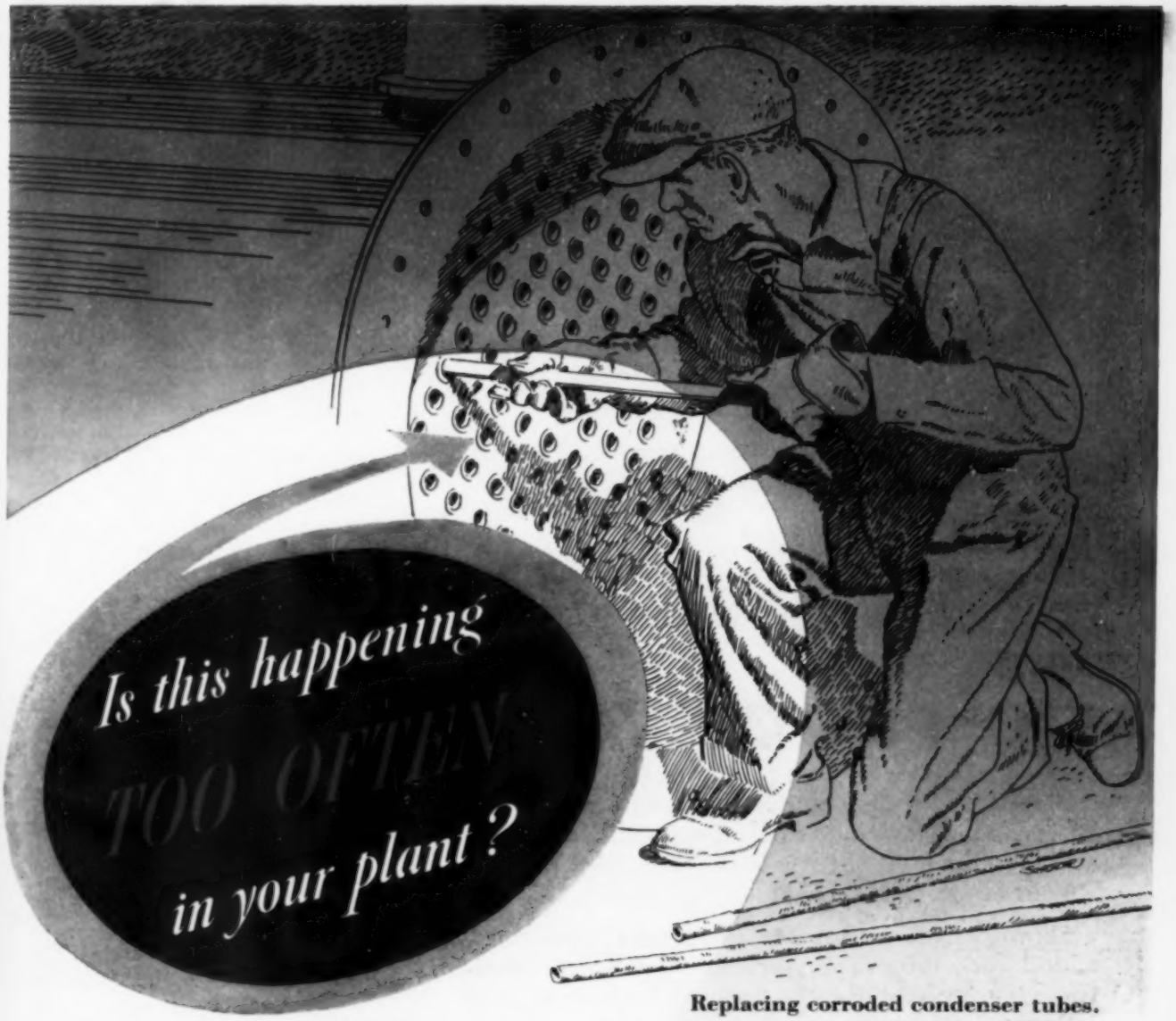
WYANDOTTE HOLDS SECOND ANNUAL SEMINAR

MEETING at the Detroit Statler in January, staff members of the Wyandotte Chemicals Corp. research department held an all day seminar on coordination of sales, development, and research. Dr. Thomas Vaughn, director of research, discussed advertising, sales, production, and development activities of the company and explained their relationship to the research department of the organization. Other speakers at the seminar were: C. B. Robinson, Bert Cremers, M. E. Clark, H. F. Roderick, L. D. Dodson, M. A. Thompson, Dr. P. E. Burchfield, Robert Raine, and W. F. Torrey.

At the dinner following the meeting, Dr. Clair S. Boruff, technical director of research and development, Hiram Walker and Sons, Inc., spoke on "Research on Alcoholic Beverages."

INCO BROADENS COOPERATIVE EDUCATIONAL PROGRAM

BROADENING of International Nickel Co. cooperation with universities and colleges in the U. S. and Canada in the field of engineering education through the distribution of technical literature was announced last month. The new program will make available useful material for classroom instruction in training students in scientific fields. It has been offered to, and accepted by, a number of important institutions which give accredited courses in mining, metallurgy, chemical engineering and one or more other engineering courses. As rapidly as possible the program will be offered to all engineering schools. It will be an activity of the company's develop-



Replacing corroded condenser tubes.

Condenser Tubes of Alcoa Alclad Aluminum may be the answer to your corrosion problems

The idea's not new. Condenser tubes of Alcoa Aluminum are already employed in all manner of processing plants. The aluminum safeguards product quality. And it offers high resistance to the attack of corrosive cooling waters and of materials being processed.

Now, a new development in tubing is offered —Alcoa Alclad—strong aluminum combined with a highly protective interior coating of aluminum. An even greater number of gases and liquids can be handled by aluminum condenser tubes than before.

Why not try aluminum tubes in one of your condensers? In addition to being long-lived, tubes of Alcoa Alclad are surprisingly low in first cost. See our nearest sales office or write ALUMINUM COMPANY OF AMERICA, 2151 Gulf Building, Pittsburgh 19, Penna.

ALCOA FIRST IN **ALUMINUM**

ALCOA

ment and research division, with Dr. W. A. Mudge, assistant director of technical service on mill products, directing. Prof. Wm. B. Plank, head of the Department of Mining and Metallurgical Engineering, Lafayette College, Easton, Pa., and recently a member of the Engineers' Council for Professional Development, will act as consultant.

SUN OIL ISOTOPE PLANT TO BE COMPLETED IN APRIL

RECENTLY Sun Oil Co. announced that its plant under construction for the production of Carbon 13 is expected to be completed April 1. Because of the time involved in reaching equilibrium in the plant, it will be about July 1 before production is obtained. Carbon 13 will be put out in the form of a solution of potassium bicarbonate. The concentration of Carbon 13 as based on total carbon will be about 10 percent.

Mills-Packard type sulphuric acid plant at Moultrie, Ga., completed late in 1946 as part of a new superphosphate plant of C. O. Smith Guano Co. Andrew M. Fairlie, of Atlanta, was consulting and supervising engineer

SEATTLE FIRM NOW OPERATES SALEM ALUMINA PLANT

THE $5,000,000 Salem, Ore., alumina plant has now been leased to Columbia Metals Corp. of Seattle and has been operating since the first of the year as a private industry. Originally built for the experimental production of a reduction-grade alumina from Oregon high-alumina clay, the plant was put in standby condition last July, but the unit was allowed to continue production of ammonium sulphate fertilizer for UNRRA and domestic agricultural uses.

Currently, the U. S. Treasury Department is purchasing 34,000 tons of the fertilizer, which is being docked in Portland for shipment, chiefly to the Orient. A. W. Metzger, plant manager, reports that an average of 70

tank carloads of anhydrous ammonia and 115 tank cars of sulphuric acid are being received at the plant monthly and that from this is produced 6,000 tons of sulphate. In addition to foreign shipments, some 1,000-1,500 tons a month are being sold for consumption in California, Oregon and Washington.

STAUFFER CHEMICAL REPORTS WESTERN EXPANSION

PROGRESS of the $835,000 expansion program of Stauffer Chemical Co. has recently been announced. The program consists of expanding facilities for producing superphosphate fertilizer at the firm's Stege and Vernon plants, a new agricultural research laboratory in California, and expanded facilities for producing sulphur, insecticides and other agricultural chemicals at Berkeley and Portland.

Just completed is the $370,000 plant expansion at Vernon, Calif., for increasing output of superphosphate fertilizer. At Stege, Calif., a $160,000 expansion program is in progress which, together with the Vernon project, will essentially double the firm's superphosphate capacity in the West. The Stege program, which will probably be completed by late Spring, will enable the plant to operate present superphosphate manufacturing equipment at greater capacity. Foundations for the new building at Stege have been poured, and steel construction is under way.

In Berkeley, construction has been completed on a warehouse building for San Francisco Sulphur Co., a wholly-owned subsidiary. Additional manufacturing equipment has also been installed that will increase this plant's capacity by at least 20 percent. Construction of a new agricultural research laboratory near Los Altos, Calif., is planned to get under way in February.

DIAMOND BUILDING NEW HEADQUARTERS UNIT

DIAMOND ALKALI CO. made known its intention in January to build an administrative office and a research and development laboratory near Cleveland, Ohio, at an estimated cost of $2 million. This newest project of the company will be built about 12 mi. east of downtown Cleveland, and 18 miles from Painesville.

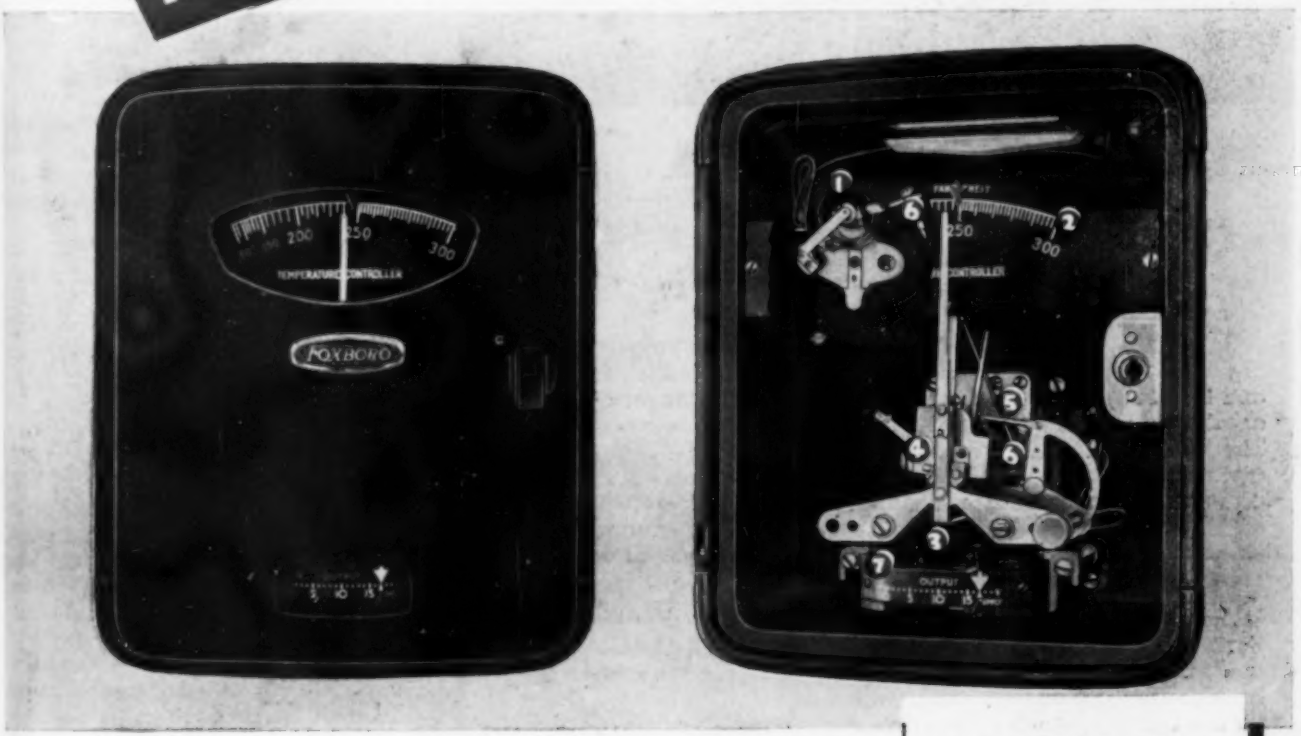
ILLINOIS TECH OFFERS GRADUATE AWARDS

TO FURTHER stimulate graduate study in science and engineering, Illinois Institute of Technology is again offering fellowships, scholarships, and

The NEW FOXBORO M-41 CONTROLLER

Purposely designed for Simple Processes

- HIGH ACCURACY
- LOW MAINTENANCE
- LOW FIRST COST



NOW . . . automatic control of simple processes can be economically justified with the introduction of this new Foxboro M-41 Controller. It has been designed from start to finish for the control of simple processes that do not involve complex process lags.

On simple processes, the majority of which call for on-off control, performance depends primarily on the precision of the on-off control action. The Foxboro Model 41 Controller has been designed to give the most precise on-off action possible. For certain purposes, however, it may be conveniently adapted on-the-job to give proportioning action between ¼% and 10% of scale.

The engineering design and quality of construction of the M-41 Controller are on a par with other famous Foxboro Instruments . . . some of its parts are interchangeable with them. All parts are engineered with typical Foxboro care.

Wherever you have simple processes that involve the control of temperature, pressure, liquid level or relative humidity, consider this new Foxboro Economy Controller. It offers, through automatic control, the advantages of greater uniformity of product and higher plant efficiency with lower cost. Write for Bulletin 388 for complete details. **The Foxboro Company, 16 Neponset Ave., Foxboro, Mass., U. S. A.**

1. Standard Foxboro Measuring Element
2. 4" Scale
3. Sturdy, simple easy-to-remove control unit
4. Proportioning Mechanism that moves on single center of motion as control setting knob is changed
5. Control Relay . . . same as M-40
6. Exclusive Foxboro Ball Linkage
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Rotax (electric) Controllers in matching cases also available.

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assistantships for the term beginning Sept. 22, 1947. Among the fellowships which permit advanced study with unusual experience in special fields of research leading to either a master of science or a doctor of philosophy degree are: Illinois Institute of Technology Research Fellowships, Universal Oil Products Fellowship in Chemistry, Westinghouse Educational Foundation Fellowship in Power Systems Engineering, Institute of Gas Technology fellowships in cooperation with the affiliated Institute of the Gas Technology, and Armour Research Foundation Industrial Research Fellowships. Although all fellowships have different stipulations and provide varied stipends, the basic requirement is a bachelor of science degree from an accredited college. Selection is made on the basis of personal qualifications and interests as well as on the scholastic ability of the candidates. All applications must be submitted to the Dean of the Graduate School, 3300 Federal St., Chicago 16, Ill. by March 15. Application forms and further information may also be obtained from the office of the dean.

CELANESE ACETATE YARN PLANT NOW UNDER CONSTRUCTION

FIELD work on the site of the new Celanese cellulose acetate yarn producing plant at Rock Hill, S. C., has begun. Construction of the new plant received final CPA approval last November. Upon completion the Rock Hill plant is expected to cost about $37 million and to employ about 3,000 persons. A contract for the general building construction has been awarded the Daniel Construction Co., Greenville, S. C.

MONSANTO ADDING TO DETERGENT OUTPUT

CONSTRUCTION of a $3 million plant in Monsanto, Ill., to expand production of synthetic detergents was announced recently by Monsanto Chemical Co. The one story, concrete building under construction will be in operation this year. The company's plant at Nitro, W. Va., is being enlarged to increase further their production of detergents.

NATRIUM CWS PLANT LEASED TO GLYCO

THE Marshall Chemical Warfare Service plant at Natrium, W. Va., used during the war for the large scale production of chlorinated aliphatic solvents and hexachlorethane, has been leased from the government by the Glyco Products Co., Inc., Brooklyn, N. Y. The plant covers an area of over

THE PLANT BEHIND THE PRODUCT

Newest Equipment
Newest Techniques

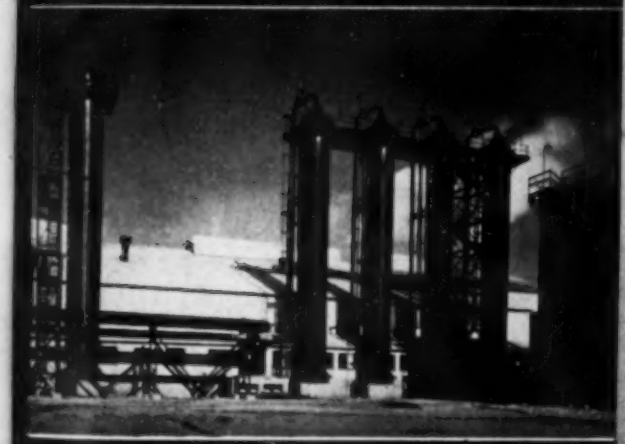
For Manufacturers of

Basic Chemicals

★ PITTSBURG, KANSAS

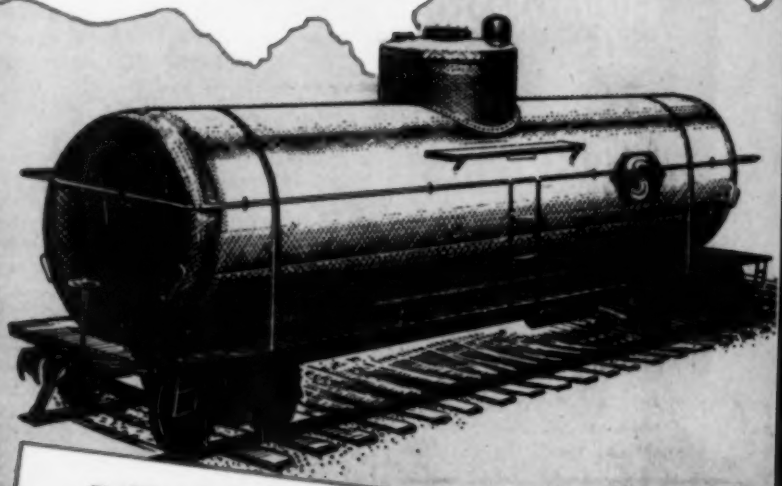
CENTRALLY LOCATED TO SERVE ALL U. S. A.

VIEW OF SPENCER'S NEW WORKS AT PITTSBURG, KANSAS, LOCATED IN THE GEOGRAPHICAL CENTER OF U. S. A.



SECTION OF WATER SCRUBBERS

VIEW OF THE "AMMONIA LAB"



ARE YOU READY FOR 1947?

With demand still pacing production, it is practical to broaden your base of Supply for your 1947 requirements of Aqua Ammonia and Anhydrous Ammonia, NH_3.

The vast new, war-proven Spencer works is prepared to make direct tank-car shipments, as scheduled, to any part of the United States. Spencer's central location expedites delivery . . . assures an even, economical rate of production. It is practical to schedule orders well ahead. Write, wire or phone today.

Spencer Chemical SPENCER COMPANY

General and Sales Offices: Dwight Building, Kansas City 6, Missouri

Works: Pittsburg, Kansas

84 acres adjacent to the Ohio River and is composed of 14 buildings. Manufacturing operations are expected to start about March 1.

BUREAU OF MINES EXTRACTS MAGNESIA FROM OLIVINE

DEVELOPMENT of a commercially feasible process incorporating a new time-saving filtration method for the extraction of magnesia from olivine, found in extensive deposits in western North Carolina and in the Puget Sound region of Washington, was announced recently by Dr. R. R. Sayers, Director of the Bureau of Mines.

The Bureau magnesia extraction method involves the digestion of sized olivine with hydrochloric acid solution and the subsequent elimination of impurities such as iron and nickel by their precipitation as hydroxides. In developing this process, Bureau engineers overcame one of the primary barriers to acid decomposition of silicates which has been the prohibitively low filtration rates of the reaction slurries. By the use of a newly-developed multistage digestion innovation, a 10-fold increase was effected over normal filtration rates.

SALT LAKE ALUMINA PLANT TO BE SOLD

BIDS have now been received by WAA for sale of the Salt Lake City, Utah, alumina plant, one of the four government - financed experimental plants erected during the war for production of alumina from non-bauxite domestic ores. Operated by Kalunite, Inc., and costing $4,905,000, the plant was still in preliminary stages of operation when it was ordered shut down. Designed annual capacity was 72,000,000 lb. of alumina. Situated on 79 acres, plant facilities include sulphuric acid recovery plant, waste disposal facilities, a furnace house containing seven multiple-hearth Skinner type furnaces, a chemical and thickener building containing filters, crystallizers, rotary dryers and Dorr classifiers, and a crusher building containing jaw crushers and hammer mills.

PAPER PLANT EXPANSION APPROVED BY CPA

A NEW plant addition that will increase the production of paper 100 to 150 tons per day will be constructed for Gulf States Paper Corp. by the H. K. Ferguson Co. at Tuscaloosa, Ala. Included in the new construction will be the installation of a new paper machine, together with the necessary pulp production facilities, recovery capacity and other auxiliaries. The

INCIDENTS FROM SMITHway PRESSURE VESSEL RESEARCH

PROJECT No. 2229

Successive heats of the same alloy react differently to corrosion

SO COMPLEX is the service to which modern equipment is subjected that it is no longer safe to predict the corrosion resistance of an alloy steel, *after* fabrication and welding, on the basis of the alloy's AISI type number.

At A. O. Smith, records of the Metallurgical Laboratory reveal an increasing number of instances in which successive heats of identical alloys behave quite differently, in service. Under these circumstances, achievement of assured dependability in performance requires much more than ordinary precautions, such as mill inspection and chemical analyses.

Today, utilizing data obtained over a ten-year period from many thousands of tests in A. O. Smith laboratories, it is possible to select from heats of the same alloy those which will meet specific requirements for corrosive service in the finally fabricated structure.

Results of corrosion tests on cross-welded plates of AISI Type 316 stainless steels from two heats of similar chemical analyses.

A. O. Smith Research and Engineering Building, Milwaukee

A. O. SMITH Corporation

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Chicago 4 • Tulsa 3 • Midland 5 • Dallas 1 • Houston 2 • New Orleans 18
Seattle 1 • San Francisco 4 • Los Angeles 14
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WELDING EQUIPMENT • TURBINE PUMPS • PETROLEUM METERS • AND OTHER PRODUCTS

present production rate at the plant is 200 tons per day. The project has been authorized to proceed by the CPA. The contract awarded to the Ferguson Co. covers engineering, construction and installation of process equipment.

CELANESE SETS UP CHEMICAL ENGINEERING FELLOWSHIP

ESTABLISHMENT of the Celanese Corp. Fellowship in Chemical Engineering at the University of Michigan, Ann Arbor, Mich., was announced in January. The fellowship is for a term of five years from the time of the appointment of the first recipient, and the subjects to be investigated under the fellowship shall relate to the field of plastics and high polymers. The company established a fellowship in the general field of chemical engineering at Princeton University in June, 1945.

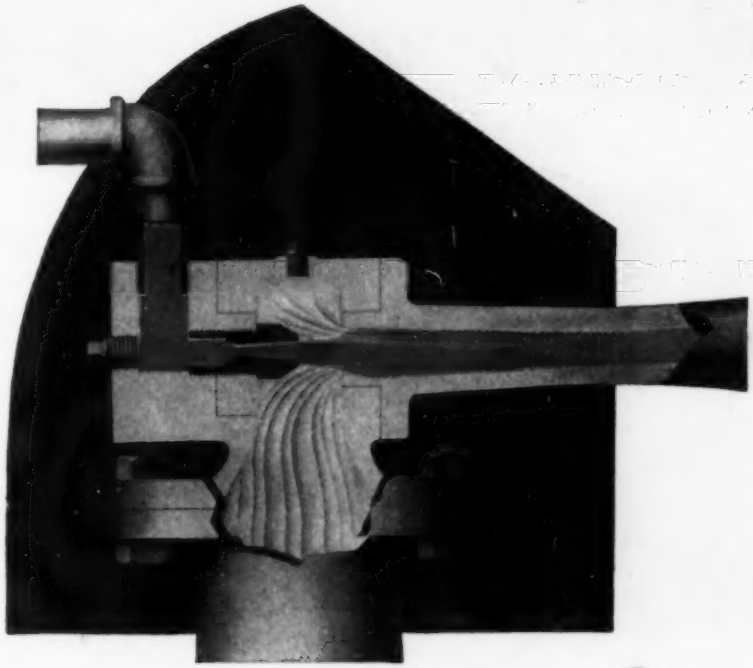
GRADUATE RESEARCH PROGRAM ON FLOTATION AT M.I.T.

A FUND of $12,000 for a graduate research program in the fundamentals of mineral flotation has been established at M. I. T. by Armour and Co. This program will concentrate on the operation of cationic collectors, particularly amines and amine salts. These cationic collectors when dissolved in water give hydrocarbon-chained ions that are positively charged. Most flotation reagents, such as the xanthates, soaps and fatty acids give negatively charged hydrocarbon-chained ions. A. M. Gaudin, Richards Professor of Mineral Dressing, will direct the program.

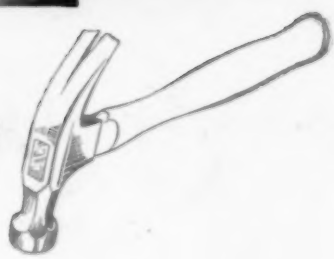
MONSANTO EXPANDS RESIN FACILITIES IN SEATTLE

TO BE built in Seattle, Wash., the first unit of a $2,000,000 Northwest expansion program by Monsanto Chemical Co., has now received CPA approval. To cost some $1,000,000 this unit will include two structures for the manufacture of soy bean glue and wood preservatives. Construction is scheduled to start this spring. The new facilities, it is reported, will not affect operations of the firm's present Laucks plant in Seattle which has been a long-time producer of soy bean and casein glues and resin adhesives of the phenol-formaldehyde, urea-formaldehyde, resorcinol and melamine types. Most of the output of this plant has been used by the Northwest plywood industry. Also just announced is the formation of a Western division of Monsanto in Seattle to supervise West Coast operations. Consisting of four plants, the new division will handle the Northwest manufacture of plywood glues, paints, and wood preserv-

an S&K "reason why"



no more complicated than a hammer



A hammer is a simple, functional tool.
It has nothing to get out of order.
S&K Jet Pumps are similar to a hammer.
They have no moving parts to get out of order.
They have no glands to adjust or replace . . .
No bearings, no rotating or reciprocating parts to wear.
They lift or transfer liquids or solids . . .
Exhaust liquids from tanks . . .
Produce vacuum or pressure . . .
Mix and agitate liquids . . .
Mix gases . . .
And perform many other functions . . .
SIMPLY!
Assure yourself efficient operation.
Eliminate "down time" and maintenance.
Reduce your costs.
Send, today, for Bulletin J-1.
Find out how S&K Jet Pumps can work for you.

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atives. General manager of the newly-formed Western division is Harry P. Banks.

GEORGIA ERECTS MEMORIAL TO CHARLES HERTY

GEORGIA paid its respect to Dr. Charles Holmes Herty, one of the State's greatest scientist whose timber product discoveries created new industries, recently when a bronze memorial was unveiled in the State Capitol.

Ex-Governor Arnall spoke informally at the ceremony of the great work of Dr. Herty, whose research pioneered development of Southern pine into newsprint. The memorial was unveiled by Charles Holmes Herty, III, son of the scientist.

READERS' VIEWS and COMMENTS

SILICONE GASKETS

To the Editor:

Sir:—We were very interested in your article in the November 1946 issue on chemical and heat resistance of gasket materials. We were particularly interested in the tabular material on the resistance of the silicones which we feel is an excellent presentation of their resistance to various chemicals.

We feel, however, that the statement "The recently developed silicone compounds are said to be useful as high as 575 deg. F., but because of their scarcity their current applications have been rather limited" is not entirely correct. This company has manufactured quite a large number of gaskets into silicone rubbers by molding, extruding and dieing out silicone coated Fiberglas fabrics. In some cases the quantities of these gaskets have run into hundreds of thousands.

The material is not particularly scarce, but it is difficult to manufacture and highly expensive. These factors have tended to limit the use of the silicone rubbers in gasketing to those cases where the heat problem is such as to warrant the added expense.

The fabrication of the silicone rubbers is so new that we are afraid many engineers feel with you that the material has a limited application. Actually, production is growing rapidly and it is finding a broadening field that has not been adequately covered by earlier gasketing materials.

J. A. MOFFITT
President
Connecticut Hard Rubber Co.
New Haven 9, Conn.

NEWS FROM ABROAD

FURTHER DROP IN COAL SUPPLIES HAS FORCED SHARP DECLINE IN BRITISH CHEMICAL OUTPUTS

Special Correspondence

TRANSFER of Britain's nationalized coal mining industry to the State-owned National Coal Board on January 1 coincided with the worst fuel crisis yet experienced in the country. The absence of reserve stocks and transport delays due to exceptionally cold weather threatened to cause extensive stoppages, and it was only by last-minute emergency shipments that greater harm was avoided. The fuel shortage is due to increased consumption as much as to lower production. Outputs at most mines are indeed increasing, though the overall labor force in British collieries tends to decline. Even so there is a gap of 300,000 tons weekly between supply and potential demand and no hope of early relief.

To meet the emergency, the old system of fuel quotas had to be abandoned, and the general 5 percent cut of industrial coal and electricity consumption imposed before the end of 1946 gave way as from January 20 to a "realistic" system of allocations, related to anticipated deliveries, which gave increased power to regional fuel officers. As early January deliveries in some districts lagged 40 percent behind quotas, the change to a new allocation basis was generally welcomed. Luxury and semi-luxury industries must submit to severe cuts, but chemical works are given priority. Subject to local variations, they will rank on an equal footing with iron and steel plants and industrial coke ovens, which are to get 20 percent less coal.

The opinion expressed at one important chemical factory in the sorely-tried northwest was: "It will probably mean less coal, but it is very important that we should be sure of our allocations." This comment is typical, since hand-to-mouth dispositions are singularly ineffective in big chemical works. The precarious coal position forced producers of soda ash to ration their customers, and similarly drastic cuts would have become necessary for caustic soda but for substantial end-of-year stocks.

The allocation system in operation now necessitates far-reaching rearrangements in British chemical works fol-

lowing the sharp output cuts effected earlier. In one big alkali plant production was cut by 35 percent in five weeks and this reduced consumption had to be lowered by a full quarter because coal receipts went down to one-third of the amount needed for proper plant operation. Another factory owned by the same big company had to close temporarily owing to exhaustion of stocks. Coal-tar distillers are faced with a bleak prospect because of curtailed operation of industrial coke ovens; many coke producers try to effect coal economies by neglecting by-product recovery.

Coal-tar distillers, though faced with an excess of demand over supply, will thus be forced to cut down operations. As usually at this time of the year, many of their customers have placed long-term contracts covering the next six or twelve months, and from the volume of new business placed it appears that little of the distillers' output will be left for export. Before the close of 1946 shipments of creosote to U. S. A. and pitch to France increased, partly as a result of a cut in production of pitch-creosote fuel, but this increase is unlikely to be maintained in 1947. This is regretted in official quarters because coal-tar products are among the few chemicals with a ready market in dollar countries. The supply of derivatives like phenol and cresols also is less than adequate to meet home demands; hence export licenses are granted in exceptional cases only.

Cut in Coal-Tars

In the organic chemical field difficulties are accentuated by the coal shortage and reduced throughput of coal-tar distillers. While the quantitative problem may be expected to be gradually overcome, prices are likely to rise; the new home market contracts for 1947 contain escalator clauses for automatic adjustment to the prices ruling at the time of delivery, while exports command altogether higher prices. Such price increases cannot but be reflected through the whole range of organic chemical manufactures down to the finished products.

Raw material difficulties, together with shortages of plant, labor and essential services, are the principal obstacles to a speedy execution of the postwar plans of the organic chemical industry. As Lord McGowan, chairman of Imperial Chemical Industries Ltd., points out in a survey of Britain's opportunities in this field: "More than almost any other industry, we stand to suffer from any deficiency of coal, for coal is our primary material."

This fact and the need for research into the chemical utilization of coal

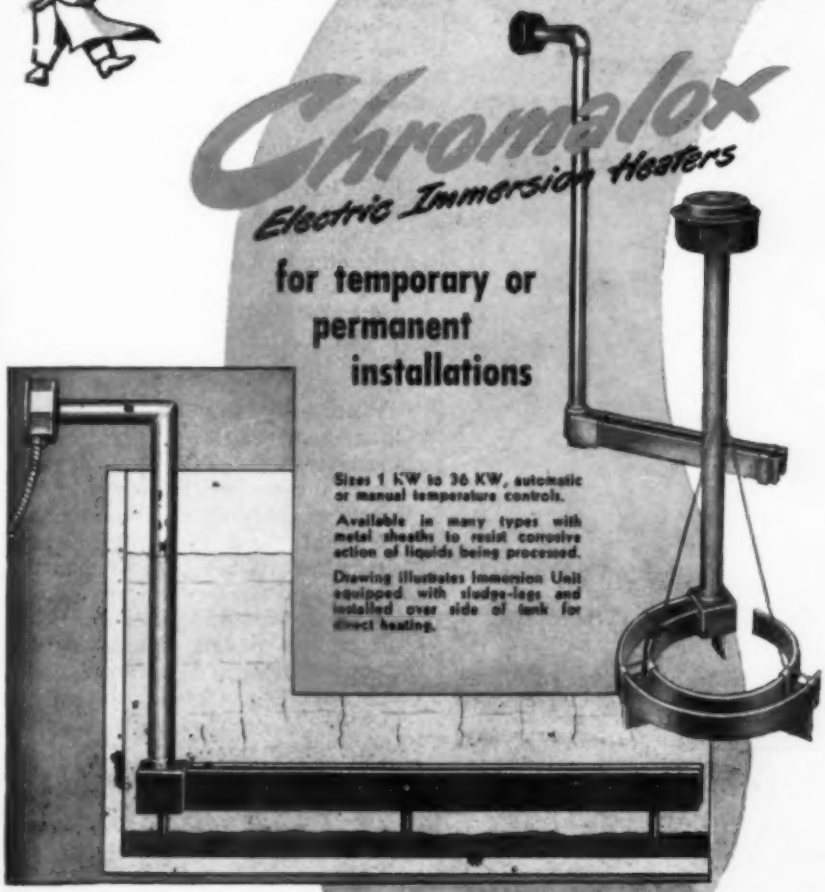
Chromy says:

"Put the Heat where you want it!"

Chromalox

Electric Immersion Heaters

for temporary or permanent installations



Sizes 1 KW to 36 KW, automatic or manual temperature controls.

Available in many types with metal sheaths to resist corrosive action of liquids being processed.

Drawing illustrates Immersion Unit equipped with sludge-legs and installed over side of tank for direct heating.

Fast · Economical · Easy to Install

Heat is right where it's needed when you equip your plant with CHROMALOX Immersion Heaters. Versatile in application—they are used as portable or permanent heat-sources in tanks, vats and other containers.

With CHROMALOX *Electric* Immersion Heaters, you can accurately heat and maintain the temperature of degreasing, cleaning, pickling and plating baths. You can melt greases, asphalts and similar viscous fluids. In fact, you can put CHROMALOX Immersion Heaters to work in almost any fluid-heating job in your plant.

Get in touch with your CHROMALOX Application Engineer. He'll gladly recommend the right equipment to give you clean, dependable, trouble-free electric heat.

CHROMALOX

Electric Heat for Modern Industry

Guide to CHROMALOX *Electric Heat* applications

Check this list

- Glue Pots
- Ink Dryers
- Cleaning Tanks
- Degreasers
- Paint Dryers
- Air Heaters
- Melting Pots
- Tempering Baths
- Heating Molds
- Soldering Irons
- Steam Boilers
- Tinning Pots
- Heat Sealers
- Oven Heaters
- Coating Tanks
- Hot Salt Baths
- Lacquer Dryers
- Space Heaters
- Baking Ovens
- Branding
- Die Heaters
- Hot Plates
- Pitch Pots
- Glue Cookers
- Driers
- Heating Castings
- Drying Ovens
- Process Kettles
- Preheating Fuel Oils
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- Wax Melting
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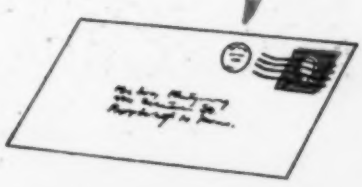

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IC-20

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is not overlooked by the National Coal Board, as is shown by the appointment of a prominent scientist to the new post of Director of Carbonisation Research. The organic chemical industry is viewing the long-term prospect with great confidence. In the words of Lord McGowan: "We enter the era of peace with a powerful research backing and an invaluable manufacturing experience . . . Britain is active and alive to the opportunity that is afforded by continued progress and research . . . We have the essential foundation of research, the industrial experience, and the manufacturing resources necessary to bring out discoveries quickly on to the market. We possess the managerial enthusiasm and drive that spring from sound knowledge and an unbounded confidence in the ability of our employees."

Wartime Growth

When war broke out, Lord McGowan remarks, the British dyestuffs industry was established in the markets of the world. The war gave the British organic chemical industry an opportunity of entering the pharmaceutical market on a good scale; methods of making established drugs were worked out and manufacture begun, and many new drugs were developed. Impressive advances have been made in the development of insecticides of unparalleled power and selective weed killers evolved out of research into plant hormones. In the plastics industry Britain is in the forefront of progress. Lord McGowan mentions mepacrine and Paludrine, the anti-malarials Perspex and polythene, among plastics, and Terylene, the new synthetic fiber.

This distinction between short-term and long-term programs is typical of the policies pursued in Britain to deal with the aftermath of the war. The current demand for goods of all kinds is so great that it permits no slackening, while on the other hand the omissions of wartime at the same time call for prompt initiation of a large reconstruction and re-equipment program. The National Coal Board, faced with this twofold task, is making a clear distinction in its plans accordingly, and many leading chemical producers in the British Isles are confronted with a similar complex of tasks. While the customers' urgent need for supplies is big enough to keep the whole labor force of the chemical industry, swollen as it is by wartime additions and postwar re-instatements, fully employed, executive and technical staffs are kept busy drawing up extension and modernization schemes to cope with the anticipated more stringent demands of tomorrow.

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• PRODUCTS FROM COAL •

SOUTH AFRICAN CHEMICAL PLANTS DEVELOPING NEW PROCESSES IN SOAP PRODUCTION FROM SLUDGE

Special Correspondence

SOUTH AFRICAN chemists at the Johannesburg sewage disposal works at Cydna have been experimenting with the recovery of fat from sewage to make soap. The chemists estimate that, if sufficient equipment is made available, they will be able to produce more than 100,000 lb. of soap a year.

The soap produced is to be used to help the municipality to overcome the present soap shortage. This is the first time the experiment has been attempted in South Africa. It has been undertaken as the result of the research of J. H. Wilson, the biochemist in charge of the laboratory division of the Johannesburg city council. Mr. Wilson is assisted by a staff of 11 chemists, one micro-biologist and two technical assistants. Farmers may also soon benefit from the work of these city chemists, as the city council has voted £10,000 for experiments on the sterilizing of sludge to produce a safe fertilizer.

Mr. Wilson said: "We can claim that Johannesburg is leading the world in the utilization of sludge gas." In 1945 the chemists at Cydna produced their first sample of methyl alcohol from sludge gas. As a result of experiments carried out in Johannesburg, a large firm has signed a 25-year contract with the city council to use 300,000 cu. ft. of sludge gas daily, from which half the amount of cyanide needed for the Witwatersrand gold mines will be produced.

Soap may not be imported into South Africa even though other countries may have surplus supplies. A Cape Town importer said he was offered 1,000 cases of soap a month by a manufacturer in Portuguese East Africa. He said arrangements were made with the Portuguese authorities to permit the export of the soap to the Union, but the Soap Controller in Pretoria stated that it could not be imported. It was explained that if soap were imported, South Africa's allocation of raw materials from overseas would be reduced correspondingly. That would decrease local production and cause unemployment in the industry. The country would also have less glycerine and cattle feed, which were byproducts of the manufacture of soap. The Brazilian consul

in Cape Town said he had received many inquiries about the possibility of importing soap from Brazil, which had plentiful supplies. He was inquiring whether Brazil would be prepared to export soap to the Union and on what terms, but he did not know whether the importation of soap would be permitted by the Union authorities.

Red oxide to the value of nearly £5,000, which is being mined on a farm in the Bethal district of the Transvaal, is being exported to the United States and Britain. A geophysical survey which started there some months ago is still being conducted on behalf of a finance and development company in Johannesburg. What the survey has so far disclosed is being kept secret, but the company recently paid out large fees in respect of options it has leased over mineral rights in the district.

A government control which may be established in South Africa shortly is that of soda ash. A small amount of soda ash is produced in the Pretoria district, but the bulk of the Union's requirements is obtained from the Magadi Mines in Kenya. Other countries which formerly imported soda ash from Britain are also making heavy demands on the Magadi Mines, with the result that the Union's quota has lately been greatly reduced. Hence the control of soda ash seems inevitable.

New Soda Ash Plant

A £1,000,000 soda ash plant is to be established in the Union. Marble, Lime and Associated Industries announces in its annual report the conclusion of negotiations for the establishment of a soda ash plant, which is to receive encouragement by the Union Government. The chairman, Dr. P. Snideman, has left for America to obtain the plant. Shareholders are to be given subscription rights in the projected Alkali Chemical Corp.

The chairman of the Iron and Steel Corp. announced that its subsidiary, the African Metals Corp., at Vereeniging, had succeeded in making synthetic bone-meal. "We lose a large number of cattle because of the lack of bone-meal," he said. "It was now being made from basic minerals, and will save our cattle industry." As soon as possible works would be built and enough synthetic bone-meal would be made for every animal in South Africa.

Marble, Lime and Associated Industries, Wright Boag Street, Johannesburg, have erected a factory at Merebank, Durban, where it has installed modern plant for the manufacture of chrome tanning salts, bichromates and chromic acid. These products are being exported overseas and the manufacturers claim that the new plant will enable them to pro-

duce quantities sufficient to meet demand while retaining quality standards.

The present shortage of paint in South Africa is expected to continue some time in 1947, when the first shipments of linseed oil from Argentina are expected. The price of the Argentine oil will probably be high, and the price of paint will probably have to be increased. Hundreds of thousands of gallons of paint are needed not only for new buildings but for ordinary maintenance demands. In the meantime local paint manufacturers are rationing their customers severely. The price of dehydrated castor oil, which is being imported in place of linseed oil, has recently risen to as high as 19s.6d. a gallon. South Africa formerly bought most of its linseed oil from India. Now India is exporting to Britain all the oil she does not use herself in the development of her own industries.

Ochre Mines

The war has dealt kindly with the ochre mines of the Riverside district of the Cape. Their supplies to the paint and distemper factories of the world brought in £20,000 a year ten years ago. Now the figure is about £50,000 a year. Possibly the market would have expanded still further if shipping difficulties had not hamstrung the industry for about six years. Now the leeway is being made up, as the South African product meets with strong demand in the face of competition from Spain. Spain's price is lower, but the Union product is held to be of superior quality.

Two concerns are operating the five mines which produce South African supplies. All are within an area of about 12 by 8 miles. The refining is done at Congella, Durban. Production was limited during the war. On the other hand, exploration was stepped up. Large deposits were traced, and sufficient to meet all demands for another 25 years at least were found. The industry used to employ white labor. Now it finds colored workers more suitable. The mines produce some useful sidelines. Large deposits of china clay and kaolin are extracted, as well as supplies of fuller's earth. Silica, which rock overburdens the ochre, finds its way mainly to the Witwatersrand, where it is used to make furnace bricks. The industry was pioneered by a firm in Bristol, England, through whose activity extensive quarrying was started 16 years ago. The ochre is produced cheaply, for labor and transport are not high. It is easily quarried, and a high grade is maintained by the proper selection of the material by hand.

CROUSE-HINDS

50th Anniversary

HALF A CENTURY OF ACHIEVEMENT

1897 Fifty years ago two men each had an idea. Huntington B. Crouse had an idea. He wanted to be a business man. Jesse L. Hinds had an idea. He wanted to manufacture articles for the electrical trade. A mutual friend brought the two men and their ideas together and on January 18, 1897 the Crouse-Hinds Electric Company was born. It manufactured electrical switches, panelboards, switchboards, and the patented Syracuse Changeable Electric Headlight for trolley cars. The headlight was the forerunner of the extensive line of lighting equipment manufactured later.

1903 The partnership was replaced by a corporation — Crouse-Hinds Company.

1906 A newly invented line of electrical conduit outlet bodies with threaded hubs was now manufactured. A new name was needed, so the word "CONDULET" was coined. It was adopted as a trade mark and registered in the United States Patent Office. Condulets were destined to revolutionize electrical conduit installation practice.

1910 Mr. Crouse formulated a firm policy of equal discounts to all distributors and equal prices to other purchasers. Revolutionary in those days, it has since been generally adopted by the electrical industry.

1911 On a 25-acre plot of land the cornerstone of the present plant was laid. Additional acres and buildings have been added since.

1915 Crouse-Hinds made the first of its now extensive line of floodlights.

1922 Crouse-Hinds built the first modern four-way three-section traffic signal.

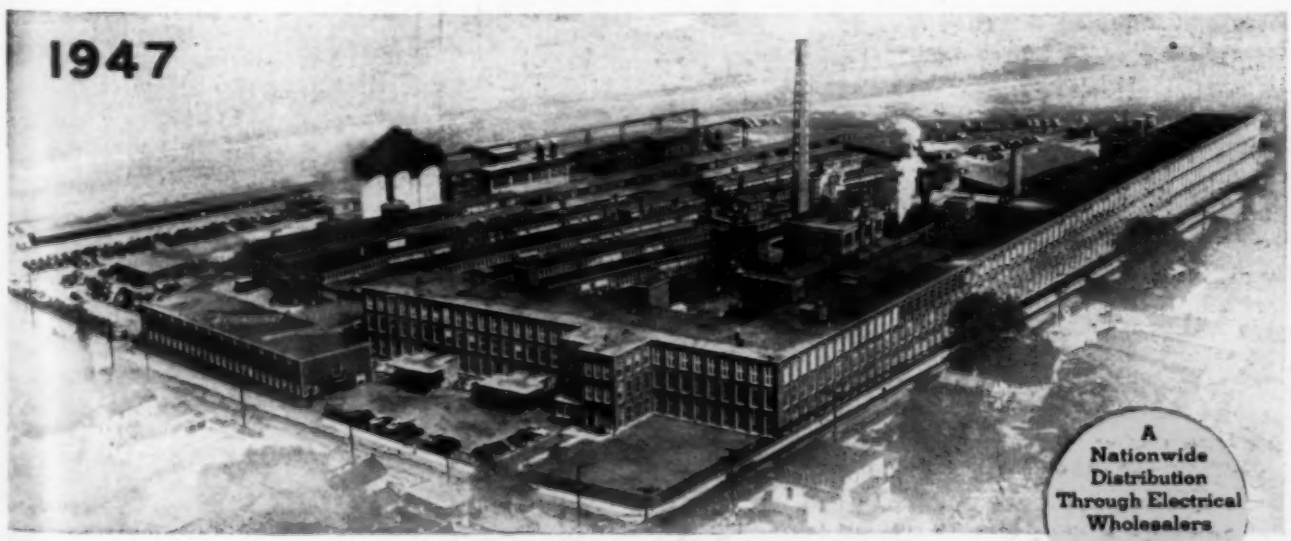
1927 Crouse-Hinds developed equipment especially designed for airport lighting.

1929 Pioneer in sports lighting, Crouse-Hinds installed a complete lighting system in a major college football stadium — at Syracuse University.

1932 Crouse-Hinds issued the first complete catalog of a line of Explosion-Proof Condulets.

1943 Upon the death of Mr. Huntington B. Crouse, Mr. William L. Hinds succeeded him as President of Crouse-Hinds Company.

1947 Now, after fifty years, the Crouse-Hinds Company has the same objectives with which it started — to make a good product better and to deal fairly and honestly with all.



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AUSTRALIAN CHEMICAL INDUSTRY IS EXPANDING DESPITE LABOR AND MATERIAL SHORTAGES

Special Correspondence

AT PRESENT Australian chemical manufacturers are faced with a shortage of raw materials and manpower. Serious industrial unrest both in the coal mines, and on the waterfront has aggravated a nation-wide shortage of bituminous coal, which has affected all Australian industry, particularly the chemical industry.

Several times during the past 12 months emergency power rationing measures have had to be introduced to maintain essential services resulting in a complete cessation of industry till coal reserves could be rebuilt to a workable figure.

While some industries have turned to oil as an alternative source of power, others have become interested in various sub-bituminous grades of coal. Recently Australian Paper Manufacturers Ltd., who are already using 1,500 tons of brown coal a week in its Victorian Works, announced they had acquired the brown coal reserves at Bacchus Marsh in Victoria, and were experimenting with its use in their boilers using spreader stokers. In South Australia, which possesses no high grade coal resources, the government has developed by open-cut mining methods, the deposit of sub-bituminous coal at Leigh Greek, 250 mi. north of the principal industrial area.

This fuel shortage, together with an ever increasing demand, has resulted in a nation-wide shortage of soda ash and caustic soda. With supplies from overseas suspended, so serious has this shortage become that a rationing system has been introduced to ensure an even distribution of whatever stocks are available. Highest priority has been awarded to industries connected with housing. Unless imports of these commodities soon become available, the rate of expansion of chemical industry in this country will be seriously retarded.

Paint ingredients, especially lithopone, are reported to be in short supply. The sodium sulphide position is acute and local users are almost entirely dependent on irregular shipments from overseas producers. The shortage of amyl acetate, which was for some time embarrassing manufacturers of penicillin, has now been relieved by supplies being made available by a western Australian manufacturer.

Meanwhile the acute shortage of

building materials is curtailing the building of new plant and the expansion of existing ones. Housing has first priority in all building materials, which are controlled under strict government supervision. To overcome this difficulty many firms have leased government munition plants which have closed down since V-J Day.

Taubman's chemical division have acquired the government TNT plant at Villawood, N. S. W., which they will use to house their new DDT plant. Allen & Hanbury's Ltd., England, will soon commence manufacture of pharmaceuticals and medical supplies at St. Mary's munition factory, N. S. W. It is reported that a section of the extension Salisbury explosive factory has been reserved for the British Rocket Mission who have recently established a rocket experimental range in central Australia.

Equally serious as the shortage of raw material is the shortage of manpower. Although apparent throughout the Commonwealth, it is particularly acute in South Australia.

After several years research by the Council for Scientific & Industrial Research into the production of furfural, a pilot plant for its manufacture from wood chips is being constructed by the Associated Pulp and Paper Co. at Burnie, Tasmania. It is understood that Jas. Hardie & Co. intend to erect a larger plant of approximate capacity of 70 tons per year, using corn cobs, oat hulls and rice hulls as these materials become available. At the moment these materials command a relatively high price as cattle fodder and it is doubtful whether furfural so produced at this stage would be economical.

Sulphuric Acid

Broken Hill Associated Smelters Pty. Ltd., at Port Pirie, S. A., have announced manufacture of large quantities of sulphuric acid for zinc purification from waste furnace gases during the sintering of lead ores. It is hoped to eliminate the need for importing high priced sulphur from overseas.

Tantalum Industries Holding Pty. Ltd., has secured options over western Australian leases and assets of Tantulite Ltd., and are applying to Canberra to register a company with nominal capital £500,000. Research work has been commenced by the company's technical staff, which has produced on a pilot plant scale the metals and alloys to be made by the large public company. Previously these ores from western and northern Australia, which have a much higher Ta_2O_5 content than that mined in South Dakota, the Ural Mts. and Greenland, were exported to overseas countries for processing.

Considerable interest has been aroused by the first annual report of

the Aluminum Production Commission, which was recently tabled in the House of Representatives at Canberra. The Commission has chosen the Bayer process as the one most suitable to Australian conditions and have shown that Tasmanian and Victorian bauxite can be used the Tasmanian hydroelectric power for the economic production of aluminum at a price which compares favorably with overseas costs. The Dorr Co. of America has tested two samples of Australian bauxite and has offered to design, erect and initiate all the plant necessary for local production of aluminum. Further investigations are being conducted in the Commission's recently established developmental laboratory to confirm that the two samples tested are representative of local supplies. Estimated cost of the project is 3 million pounds. In this respect Australia is fortunate because of its ideal position for trading with the Far East, and the improved supply of dollar exchange due to the demand for wool.

FRENCH REFINING PLANTS INCREASING PRODUCTION

SINCE the first of 1946, petroleum imports have been irregular. However, the rate of crude oil to finished products has increased continuously. In France a wise refining policy is necessary since this industry can save the country a considerable amount of foreign currency and help develop many other industries. France has started on a program to restore her refining industry that will be carried out in two steps. They are: (1) Quick restoration of undamaged or slightly damaged plants, (2) reconstruction of destroyed plants with purchases of foreign equipment.

Plants at Chourchellettes and Dunkerque have been completely destroyed. Others on the lower Seine are returning to large scale production slowly. Port Jerome has returned to full prewar capacity. The tanks destroyed by fire in 1940 have been reconstructed and the equipment removed by the Germans has been repaired or replaced. The factory at Petit Couronne has been restored to a production capacity of 800,000 tons, while Gonfreville and the plant at Notre Dame de Gravanchon are producing. On the Atlantic Coast plants at Pauillac and Bec d'Ambeze have been destroyed and the Plan of Modernization will have to settle on their fate. Mediterranean factories were practically untouched by the war and provide the largest part of the French production. Martigues has gone beyond its production in 1938 and now has a production capacity of 600,000 tons. The l'Avera has modern equip-

ment and a capacity of 600,000 tons and the Houdry catalytic process unit has a production capacity of the same amount. In Alsatia the Merkviller plant has resumed its activities.

Orders have been placed in the United States which will bring production capacity back to prewar levels. A Modernization Committee for the Fuel Industry has prepared a plant that includes a 1,400,000 ton plant in the North Departments, a group on the lower Seine producing 1,700,000 tons, another group in the Mediterranean departments with a capacity of 4,150,000 tons and the refinery at Pechelbronn using the natural resources which amounts to 75,000 tons. This makes a yearly total of 13,000,000 tons. Estimates on production for 1955, which is the year chosen as a normal one for the modernized French refineries, are set at 11,719,000 tons.

RUSSIA PLANS TO SUPPLY HER OWN RUBBER NEEDS

Russia will shortly be producing all its own rubber needs, both natural and synthetic, within the borders of the U.S.S.R. according to Soviet officials. This is expected to materialize within 24 to 30 months, assuming that Russian engineers can keep pace with the construction program for the rubber industry as outlined under the current Five Year Plan.

By 1940 Soviet engineers were able to step up synthetic and natural rubber production to fill about 80 percent of the country's total requirements.

The Russians report that under the current Five Year Plan rubber production will be doubled over the 1946 figures by 1950.

Before the war, the Soviet Union was a leading producer of synthetic rubber, constituting the bulk of rubber used in the country. In 1933, the output of synthetic rubber totalled only 2,000 tons, but this figure jumped to 25,000 tons in 1935. Most of this was produced by the "Sovpren" plant in Leningrad which turned out 20,000 tons from ethyl alcohol.

Calcium carbide provides the raw material for synthetic rubber that is being produced at the Yerevan (Armenia) gigantic plant. Armenia's synthetic rubber industry is scheduled to produce by 1950 four times as much rubber as before the war.

In the Soviet East, synthetic rubber plants are situated at Magnitogorsk in the Urals, using Kuznetsk coal, at Cheremkhovo in Eastern Siberia where rubber is made out of calcium carbide, and at Aktyubinsk in Kazakhstan, which is one of the fastest-growing centers of synthetic rubber production in the Soviet Union.

The Five Year Plan calls for the

Inside facts about a sealed electric motor

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A close-coupled motor-pump unit that operates *entirely submerged in water* at *any* well-depth. The *only* basic improvement in deep-well pump design...since BJ introduced the deep-well turbine in 1901.

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That was the problem. Engineers knew for years that a close-coupled motor-pump unit for under-water operation deep down in the well was the logical answer to shafting troubles . . . but how to seal the electric motor? Finally, in 1928, an idea was developed into a simple, positive seal and the amazing BJ Submersible Pump was born. 18 years of outstanding Submersible performance is a direct commentary on the success of the unique Submersible electric motor. *Capacities:* 50 to 20,000 gpm; *Heads:* to 1500 feet; *Motor sizes:* to 400 hp.

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YEARS OF TROUBLE-FREE OPERATION
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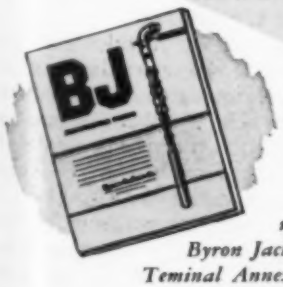

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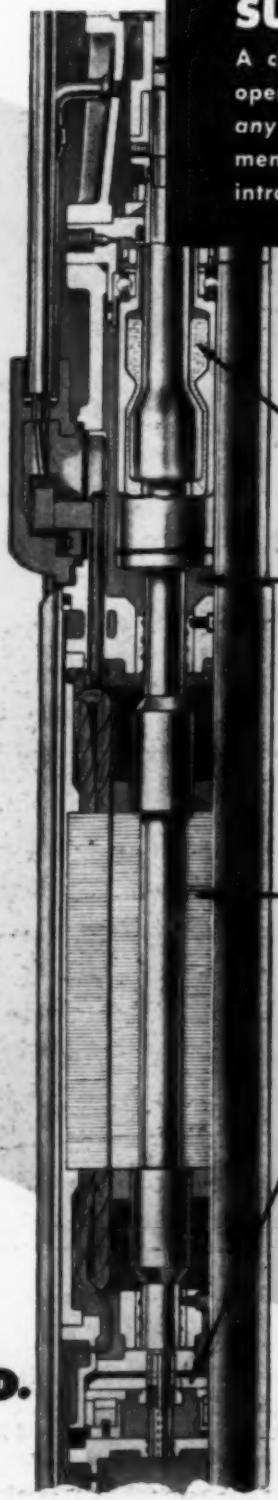

INGENIOUS MERCURY SEAL
keeps the water out and the oil in the motor.

LUBRICATING OIL
of high dielectric strength fills motor case, prevents water from contacting motor. The oil is also a cooling agent, circulating continuously to carry heat from windings to the water-cooled outer shell.

ROTOR
of relatively small diameter means low moment of inertia and quick acceleration. Ideally adapted for Full Voltage starting.

ONE THRUST BEARING
carries entire thrust load of pump and motor.

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annual production by 1950 of 88.6 million pairs of rubber footwear, or 30 percent more than before the war. To boost production, factories manufacturing rubber soles are to be built and put in operation before 1950 in Kiev, Kalinin and in a western Siberian town.

The rubber industry as a whole plans to double its output by 1950, as compared with 1940. Since reconstruction is still to be completed, this aim will actually be achieved, if things go according to plan, in 2½ to 3 years of actual production. The things that will help out are the introduction of new types of raw materials and new technical developments in the rubber industry, particularly automatic control of the production of automobile tires, as well as maximum possible mechanization of production processes. Mechanization will be stressed particularly in the production of synthetic rubber and the manufacturing of automobile tires.

Another expected development is the launching of the production of chemicals needed in the rubber industry, and not hitherto produced in the Soviet Union, as well as the production of certain complex chemical machinery and power equipment.

VISCOSE RAYON PLANT UNDER CONSTRUCTION AT BOMBAY

THE National Rayon Corp. plant to be built near Bombay by Lockwood Greene, New York, under the technical advice of Skenandoa Rayon Corp., Utica, N. Y., at a cost of about $9,000,000 will use the pot system of manufacture of viscose yarn, turning out about 8,000,000 lb. of 120 and 150 denier yarn annually. Present plans call for the plant to go into operation late in 1948 or early in 1949.

Power for the factory, which will be situated in the industrial suburb of Kalyan, will come from the grid of the Tata Hydr-Electric Co. whose dams and powerhouses in the hills south of Bombay have an installed capacity of 120,000 kw. Water for the plant, about 9,000,000 gal. daily, will be pumped from the Ulhas River which is fed by the tailwaters of one of the Tata Dams about 35 mi. upstream. Chemically contaminated affluvia will be discharged into Thana Creek which flows to Bombay.

In the initial stages the plant will use sulphite woodpulp imported from the U. S., Canada or Scandanavia while tests are being carried out on indigenous raw materials such as waste cotton, bamboo and bagasse.

It is proposed to set up a 15-20 ton sulphuric acid plant and a 5-ton carbon bisulphide plant to fill the factory's requirements.

CORROSION FORUM

MODERN MATERIALS • MODERN METALS

of Chemical & Metallurgical Engineering

Edmond C. Feller, ASSISTANT EDITOR

Wet and Dry Chlorine vs. Materials of Chemical Plant Construction

Part II of a three-part symposium in which representative materials are evaluated for services involving wet and dry chlorine and chlorine water

VITREOUS SILICA

W. W. WINSHIP
Thermal Syndicate Ltd.
New York, N. Y.

IN GENERAL, vitreous silica is not attacked appreciably by chlorine in the absence of other materials at temperatures below 1,650 deg. F. The presence of carbon, however, appreciably increases the degree of attack. R. J. Quinn (*Chem. Ind.*, 51, 872-876, Dec. 1942) states that "fused silica is suitable for handling chlorine at high temperatures, and is the only material, except platinum, that can be used for this purpose."

Atomic chlorine is reported to attack vitreous silica at high temperatures forming silicon tetrachloride but this fact is usually of only academic interest to plant chemists.

WORTHITE

W. E. PRATT
Worthington Pump and Machinery Corp.
Harrison, N. J.

WORTHITE is definitely not suitable for contact with wet chlorine gas. Dry chlorine gas at normal temperatures would not attack Worthite, but since steel is suitable for handling dry chlorine gas, as well as the liquid, there is no economical application for Worthite in these environments.

In the form of alkaline bleach solutions (sodium and calcium hypochlorites) as commonly used for bleaching textiles and paper, Worthite pumps are widely used with excellent results. Recommendations for Worthite are:

Sodium hypochlorite, cold, 3 percent max. available chlorine.

Calcium hypochlorite, cold 3½ percent max. available chlorine.

Worthite is not recommended for use in the manufacture of these hypochlorites in the concentrated form involving 15 to 23 percent available chlorine.

Worthite is not visibly attacked by weak chlorine water at ambient temperatures. Oil field salt water which has been chlorinated prior to reinjection into the oil sands, has been pumped for many years in Worthite pumps without any signs of corrosion.

TANTALUM

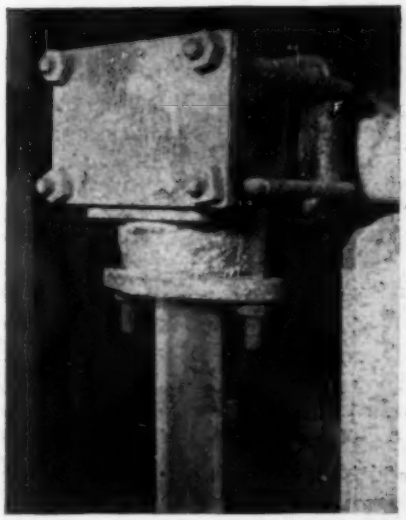
LEONARD R. SCRIBNER
Fansteel Metallurgical Corp.
North Chicago, Ill.

TANTALUM has been found inert to chlorine gas, either dry or wet, at all temperatures up to 300 deg. F., and to chlorine water. It has also been found immune to all chlorides with which it has been tested or used.

One of the first uses of tantalum was in diaphragms and needle valves for proportioning the flow of chlorine into municipal water supplies. It is still used extensively for this purpose.

Tantalum heat exchangers have been used since 1935 for reacting chlorine with ammonia to produce chemically pure ammonium chloride. Tantalum heaters and condensers are used in numerous other applications where either chlorine or chlorides present a corrosion or contamination problem.

While dry chlorine is not especially corrosive, wet chlorine, as well as many chlorides in the presence of moisture, becomes acidic. It is the acids thus evolved which pose the corrosion problem, and very few metallic materials will withstand sustained attack to any practicable extent, especially if contamination of the product is a factor. Tantalum, being inert to hydrochloric acid even at boiling temperatures, easily withstands the relatively low strength or dilute acids evolved from chlorine and chlorides.



Gaskets of Silastic withstand steam at 220 deg. F. and a 90-95 percent concentration of wet chlorine gas

SILICONES

J. A. McHARD
Dow Corning Corp.
Midland, Mich.

SILICONE materials in various forms have been tested for resistance to saturated chlorine water at 77 deg. F. and to wet and dry chlorine gas at atmospheric pressures and at a temperature of 77 deg. F. Samples of various silicone materials were exposed to wet and dry chlorine gas for seven days and immersed in chlorine water for seven days according to ASTM D 543-43. The results of these tests are tabulated below.

The resistance of silicone fluids to chlorine water is not currently available. The effects of wet and dry chlorine gas on the silicone fluids

Table I—Resistance of Silicone Fluids to Chlorine Gas at 77 Deg. F.

Type Fluid	Reagent	Viscosity Increase, %	Evaluation *
DC 200	dry gas	−0.6	good
	wet gas	1.5	good
DC 500	dry gas	4.7	good
	wet gas	2.0	good
DC 550	dry gas	2.4	good
	wet gas	2.6	good
DC 703	dry gas	17.9	fair
	wet gas	2.5	good
DC 710	dry gas	−1.3	good
	wet gas	10.0	fair

* Ratings are based on observation of the condition of test samples as well as measurable changes in viscosity.

Table II—Resistance of Silicone Resins to Wet and Dry Chlorine Gas and Chlorine Water

Type Resin	Reagent	Wt. Increase, %	Vol. Increase, %	Evaluation *
DC 993	dry gas	2.8	0	good
	wet gas	1.5	0	good
	chlorine water	7.1	38	poor
DC 996	dry gas	2.1	0	good
	wet gas	0.3	0	good
	chlorine water	3.4	0	fair
DC 2103	dry gas	1.6	0	good
	wet gas	0.4	0	good
	chlorine water	0.2	0	good

* Rating is based on a consideration of measurable changes and changes in physical appearance of test samples.

reported in Table I may be taken as an index to the resistance of various silicone greases to chlorine. Of particular interest is the effect of chlorine gas on DC plugcock grease especially designed for pressure lubricated valves. This silicone lubricant has been used effectively in valves handling low pressure chlorine gas at atmospheric temperature. Conflicting reports have been received concerning its effectiveness in contact with high temperature and high-pressure chlorine gas.

The values reported in Table II were determined on samples of solid resins. DC 993 and DC 996 are the two Dow Corning silicone varnishes for bonding and impregnating silicone insulation components and silicone insulated electric machines. DC 2103 is the silicone resin used to bond glass and asbestos cloth in the fabrication of rigid electrical laminates.

The resistance to chlorine of Silastic silicone elastomer, is given in Table III. Of the stocks reported in this table Silastic 120 and Silastic 125 are produced in the form of a paste for coating and laminating. The other stocks are produced in the form of crepes for molding, extruding and friction calendering. Silastic 181 is especially designed for use as a gasketing material. Chlorine resistance was determined on molded and cured Silastic samples.

The values given in Table III support the statement that, in general, Silastic has very good resistance to chlorine gas both wet and dry at atmospheric pressures and at 77 deg.

Table III—Resistance of Silastic to Wet and Dry Chlorine Gas and Chlorine Water

Silastic Stock	Reagent	Wt. Increase, %	Vol. Increase, %	Shore Efficiency Retained, %*	Evaluation †
120	dry gas	0	0	87	good
	wet gas	0.4	0	120	good
	chlorine water	4.5	0	106	good
125	dry gas	0.5	0	92	good
	wet gas	0.2	0	109	good
	chlorine water	3.8	0	93	good
150	dry gas	1.2	0	85	good
	wet gas	0.9	0	82	good
	chlorine water	8.0	0	72	fair
160	dry gas	1.3	0	79	good
	wet gas	0.8	0	81	good
	chlorine water	0.4	0	122	good
160 (Red)	dry gas	1.4	0	67	fair
	wet gas	0.7	0	85	good
	chlorine water	19.8	51	57	poor
167	dry gas	0.7	0	61	fair
	wet gas	0.2	0	66	fair
	chlorine water	9.3	20	38	poor
180	dry gas	0.4	0	71	good
	wet gas	0.8	0	72	good
	chlorine water	3.5	0	100	good
181	dry gas	0.1	0	82	good
	wet gas	0.8	0	74	good
	chlorine water	4.0	0	106	good

* Percent of Shore efficiency retained = (100) (hardness × elasticity of treated sample)/(hardness × elasticity of untreated sample). †Rating is based on changes in weight and volume, changes in durometer and elastometer readings, and observation of the physical condition of the test sample.

F. and to concentrated chlorine water at 77 deg. F. Generally speaking, resistance is rather better to wet than to dry chlorine gas.

In one industrial application, gaskets of Silastic 180 are used to seal the connection between a glass pipe and a ceramic elbow in a line carrying steam at 220 deg. F. and a 90 to 95 percent concentration of wet chlorine gas. In this service, black rubber gaskets hardened and started to leak after two or three days. Gaskets of Silastic 180 are still flexible enough to give a tight seal after six weeks of service (see cut page 219).

RUBBER LINING

O. S. TRUE
United States Rubber Co.
New York, N. Y.

RUBBER-LINED tanks, pipes and fittings, using both natural and synthetic rubbers, have been widely used in industrial installations involving wet and dry chlorine gas and chlorine water. Sodium and calcium hypochlorite solutions are also handled successfully by these materials.

The dry gas has very little effect upon rubber linings. Wet gas, on the other hand, does react with the surface to form a skin of rubber chloride. Chlorine water reacts the same as the wet gas—the extent of the reaction of course being dependent upon the concentration of the solution. The character of this reacted surface and the depth to which the reaction occurs can be controlled by specific compounding of the rubber. Soft rubber vulcanizates react most readily and tend to form a skin of

Chlorine tanks lined with rubber

chloride which is brittle and quite strongly adhered to the unreacted rubber beneath. Semi-hard and hard rubbers react more slowly and to a lesser depth than the soft rubbers; however the chlorinated surface tends to powder off more readily. In services involving abrasion, these hard products are sometimes subject to more rapid disintegration than soft rubber for the reason that the reacted surface is readily abraded away thus exposing more unreacted rubber.

In such cases, soft rubber is preferred despite its greater susceptibility to chlorination. The reason, as noted above, is that the reacted surface is more resistant to abrasion and is firmly anchored to its parent material.

In the majority of industrial services involving chlorine, abrasion is not a factor and semi-hard or hard rubbers are best suited. The initial reaction is rapid but the surface reaction product forms a protective film which inhibits further attack.

The solubility of chlorine in water varies from 0.98 percent at 50 deg. F. to 0.0 percent at 212 deg. F. and the higher the concentration the greater the severity of attack on the rubber. Rubber linings are available which will handle this entire range of conditions.

Outstanding examples of the use of rubber linings for severe chlorine

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services may be found in the paper industry. Both batch and continuous chlorine pulp bleaching systems are widely used. Experience has shown that rubber-lined steel is the best and most economical construction for these installations.

GLASS-LINED STEEL

O. I. CHORMANN
The Pfaudler Co.
Rochester, N. Y.

REACTIONS requiring the use of dry chlorine gas may be successfully performed in glass-lined steel equipment.

The capacity range of this equipment is very good—from 350 to 2,000 gal. Working jacket and internal pressures vary with the particular type of glass-lined steel unit selected for carrying out the reaction, 150 psi. being about the maximum internal pressure for standard units. The temperature range may be considered to be from 300 to 350 deg. Agitation can be provided in all units by means of glass coated steel agitators and baffles.

Reactions involving the use of wet chlorine gas or chlorine water may also be successfully conducted in glass-lined steel units. Standard capacities and pressures range up to 300 gal., 75 psi. in the jacket, and 38 psi. in the tank proper.

CARBON, GRAPHITE

L. C. WERKING
National Carbon Co.,
Cleveland, Ohio

CARBON, graphite, and Karbate brand impervious carbon and graphite are unattacked by dry chlorine.

Carbon and graphite are used in reactors employing dry chlorine at temperatures ranging as high as 3,000 deg. F. with no measureable attack. Such applications involve linings, tubes, heating elements, crucibles, porous carbon and perforated diffusers, and a variety of special parts. The use of graphite tubes for the introduction of chlorine into molten metallic baths for fluxing operations is standard practice.

With the exception of avoiding strong oxidants (at the specific temperatures involved) there are apparently no limits on gas concentration, temperature or contaminants. For example, any mixture of chlorine and air can be used up to the temperatures at which carbon and graphite are subject to oxidation in air, i.e., 625 and 800 deg. F., respectively.

The corrosion characteristics of Karbate are similar to those of carbon and graphite, with the exception that the temperature of the material is limited to a maximum operating tem-

SCORES

in hockey aren't made with baseball bats!

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Even though baseball bats and hockey sticks are both made of wood, they are "engineered" for different objectives. The various physical and chemical characteristics that make MOSINEE papers win in a wide range of highly specialized industrial uses, are also definitely engineered into these essential papers. MOSINEE paper technicians are equipped with scientific laboratory and production controls, plus practical "know how" based on broad experience in creating papers of many characteristics, such as extreme stretch without loss of tensile strength, high absorbency, moisture repellency, controlled pH for desired alkalinity, acidity, or neutral reaction, etc.

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perature of 340 deg. F. This material is used extensively in systems involving the chlorination of hydrocarbons. It is especially valuable in those reactions where hydrogen chloride is a byproduct since it is equally inert in chlorine and hydrochloric acid at all concentrations. Diffusers, heating or cooling elements, condensers, piping, valves, pumps and byproduct hydrochloric acid systems are regularly used in connection with the chlorination of alcohols, acetic acid, and aliphatic or aromatic hydrocarbons.

While carbon, graphite and Karbate are unattacked by chlorine, their behavior in hypochlorous acid is more variable, ranging from no attack to reasonably rapid oxidation. This is to be expected because of the oxidizing action of the reaction

$$HOCl \rightarrow HCl + O \text{ (active)}.$$

As a generalization it may be stated that Karbate is most resistant to this oxidation, followed by graphite and carbon in descending order.

Since the equilibrium of the reaction

$$Cl_2 + H_2O \rightarrow HCl + HOCl$$

is far to the left, it follows that as the chloride ion concentration increases, the amount of HOCl and available active oxygen decreases. Also, it is apparently true that for the concentrations of HOCl generally present in wet chlorine, its decomposition increases with temperature at least to the boiling point. While no definite pattern of attack versus concentration and temperature has been worked out, it apparently follows these general principles.

For example, Karbate tubes, towers, piping, etc. have operated over a period of years in 30 percent hydrochloric acid in the presence of free chlorine at temperatures up to boiling without evidence of attack. Over a period of two years the same material has shown no significant deterioration in cold saturated chlorine water, while in chlorine saturated brine at atmospheric boiling point a corrosion of 3/16 in. has been noted in a two-year period and a slightly higher rate of corrosion has been noted in uncooled wet chlorine from cells.

HASTELLOY

C. G. CHISHOLM
Haynes Stellite Co.
Kokomo, Ind.

AT NORMAL temperatures, dry chlorine gas can usually be handled efficiently by iron, steel, 18-8-3 molybdenum stainless steels, Monel metal, bronze, and copper. As soon as appreciable amounts of water are added to chlorine gas, however, it becomes one of the most corrosive agents

clean floors

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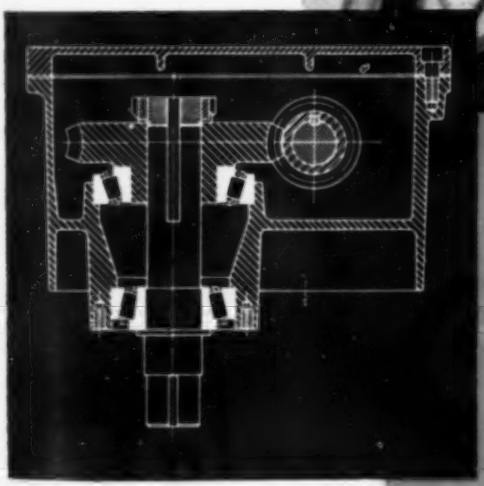

Application of Timken Bearings on the worm gear shaft of Finnell Scrubber and Dryer.

Dirty, greasy, slippery floors are not tolerated in modern factories; they are a menace to efficient operation and the safety of personnel. Factory floors can be kept clean and dry easily and economically with equipment like this Finnell No. 424 Scrubber and Dryer.

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TAPERED ROLLER BEARINGS

known, and few materials can resist it adequately. Rubber, glass, silver, and platinum can be used for this purpose, but these materials either lack the physical and mechanical properties required by the usual commercial standards, or they are too expensive. One alloy, however, that does possess the necessary corrosion resistance and physical properties for handling wet chlorine gas is Hastelloy alloy C.

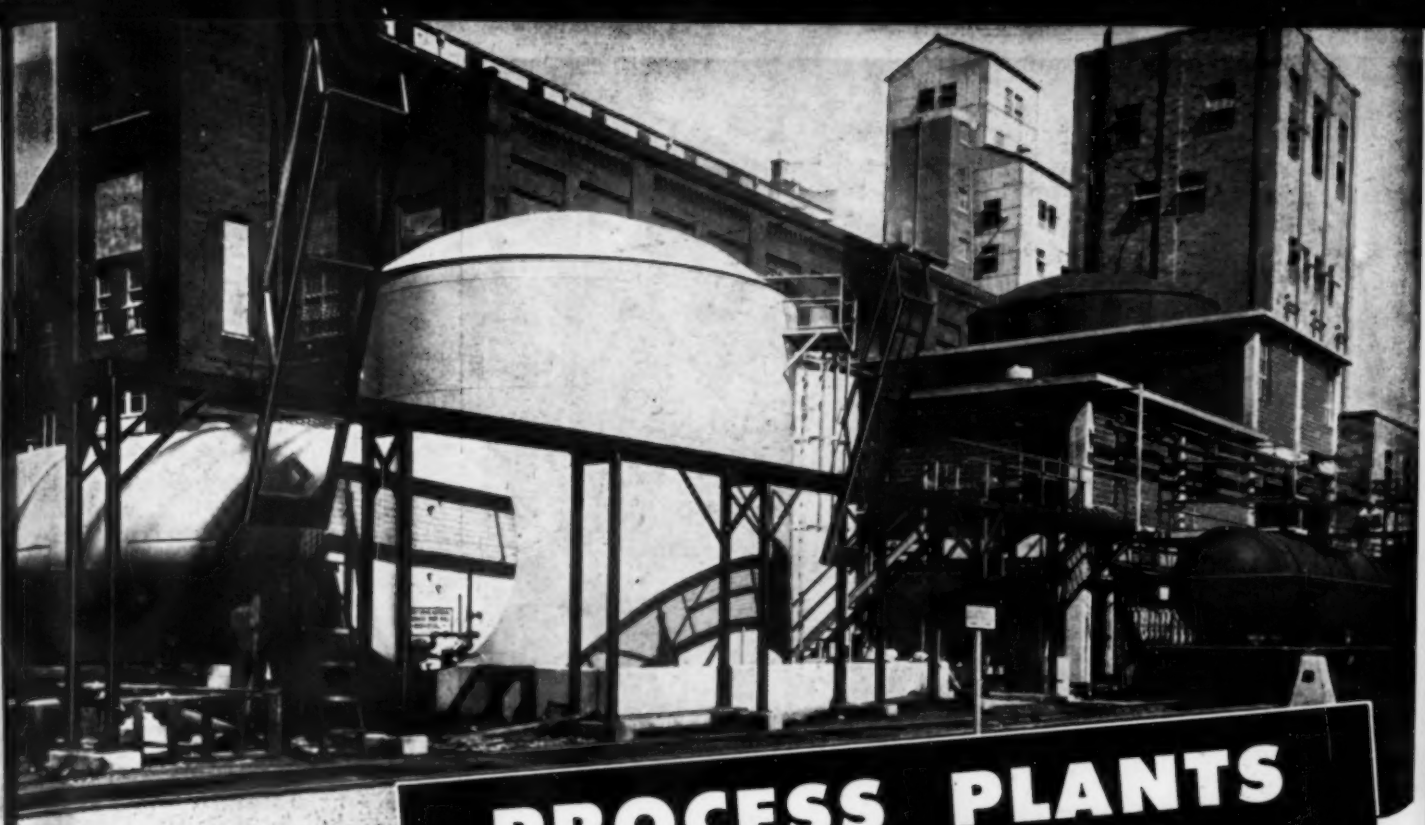
One of the standard procedures for checking the corrosion resistance of Hastelloy C during production stages is exposure of individual heats to wet chlorine gas. This test consists of suspending a specimen in a closed flask, just above the water line, and bubbling a constant stream of chlorine gas through the water. When conducted at room temperature, this is one of the toughest corrosion tests that can be made. In spite of these stringent conditions, the maximum rate of corrosion on an approved heat of Hastelloy C is only 38 mils per yr.

When this same test was conducted at elevated temperatures—at 104, 140, 176, and 212 deg. F.—a reflux condenser was used to prevent the evaporation of the water, and the atmosphere in the flask was maintained at a controlled temperature. Results of these experiments showed an appreciably accelerated rate of attack at 140 deg. F., but extremely low rates of corrosion at 176 and 212 deg. F.

A second test procedure is immersion of two flasks in an oil bath at controlled temperatures. One flask contains water and the second flask contains a specimen and no water. Chlorine gas is passed into the flask containing the water and then into the flask containing the specimen. The highest corrosion rates, as a result of this test, were obtained at temperatures of approximately 176 and 212 deg. F. The corrosion rates obtained at 104 and 140 deg. were about 38 mils per yr.

It is difficult to duplicate test data with wet chlorine gas at elevated temperatures, because the exact amount of water vapor present has a decided bearing on the actual corrosion rate at these temperatures. It is desirable, therefore, to run tests under actual operating conditions whenever possible. Under some conditions Hastelloy C has shown up very favorably in handling chlorine gas at temperatures as high as 1,800 deg. F., where, of course, very little moisture is present.

Hastelloy C has been successfully and extensively employed for handling chlorine, both wet and dry, in such equipment as valves, piping, vessels, cracking tubes, and feed pipes. It is used in one form or another for



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chlorinating equipment, used for water purification. Chlorinating tubes, for bubbling chlorine into sodium hydroxide to produce bleaching agents, is an outstanding application for this alloy. One precaution, however, should be mentioned here in connection with this type of service. In a few instances where the stronger bleaching compound has been used, the alloy has tended to catalyze the sodium hypochlorite, causing decomposition of the sodium hypochlorite solution. Although this condition has occurred in only three out of several hundred installations, it is suggested that this possible situation be checked before using Hastelloy alloy for this service. Decomposition seems to occur only in the very strong bleach solutions containing 15 to 18 percent free chlorine.

Because of the physical limitations of rubber and glass, and the high cost of such rare elements as silver and platinum, Hastelloy C has proved one of the most outstanding alloys available for handling chlorine. This alloy is available in cast and wrought form, thus making it possible to design any type of equipment required for resisting this severe corrosive agent.

WOOD TANKS

S. E. CHANEY
National Wood Tank Institute
Chicago, Ill.

IN MANY industries where wet and dry chlorine gas and chlorine water are used, wood tanks are used in the process and available records show that some tanks have been in constant use for over 40 yr. All quality tank manufacturers require the lumber producers to follow their associations' rules and lumber specifications governing tank stock for specific purposes. Consequently, where chlorine is to appear in the flowsheet, such fact must be stated so that the tank manufacturer may make the tank for the particular purpose.

Chlorine is used in systems where domestic water requires purification and in some instances wood tanks have been used in this service.

Concrete-lined wood tanks are used to make up chlorine solutions and for the storage of sodium and calcium hypochlorites. Where solutions are not always alkaline, wood tanks are generally used and are satisfactory. Sodium hypochlorite is made commercially by the reaction of liquid or gaseous chlorine in a solution of caustic soda. Where rubber-lined steel tanks are used in its manufacture, great care must be exercised in the design of the tanks and other equipment to eliminate the possibility of iron compounds contacting

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- ☐ Paraffine
- ☐ Paste
- ☐ Pyroxylin
- ☐ Resins
- ☐ Rubber Cements
- ☐ Sizing
- ☐ Soap
- ☐ Solvents
- ☐ Syrups
- ☐ Tar
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the solution because iron causes serious decomposition of sodium hypochlorite. Rubber-lined wood tanks can, and are being used for such installations.

One of the largest users of chlorine, and of wood tanks, is the pulp and paper industry. Chlorine is used in connection with the direct bleaching of the pulp, as a deodorant for sulphate pulp, and sometimes for algae and slime control. A survey of pulp and paper mills disclosed that wood tanks have been highly satisfactory in these services.

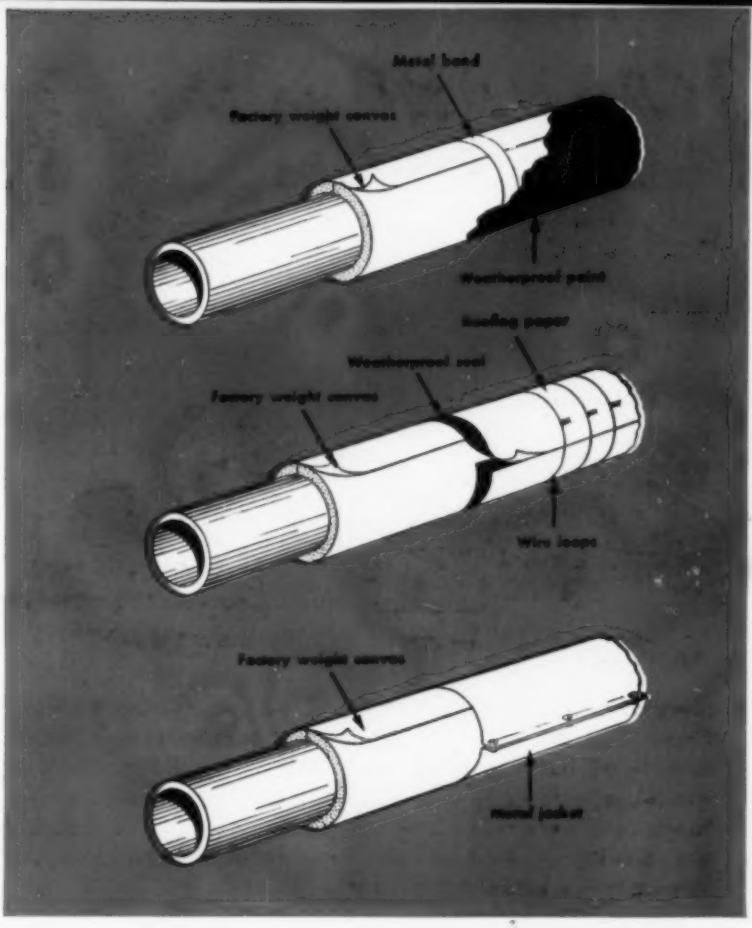
The pulp and paper industry prefers the durable woods, redwood and cypress, for tanks because of their high decay resistance, smaller shrinkage, uniform structure, and high insulating properties, as well as their resistance to various process chemicals. It is also advantageous that redwood and cypress tanks can be built in large dimensions from thick members of all heartwood. The sapwood in any conifer species is subject to premature decay, wherefore quality wood tank manufacturers only use clear all heart grade.

In the pulp and paper industry redwood and cypress are satisfactorily used for stock chests, storage tanks in milk of lime processes, agitator and mixing tanks, beaters, pulp thickeners, water storage and sprinkler tanks, and many others.

One paper plant reports a tank 3 ft. 4 in. wide, 40 ft. long, and 1 ft. high made of 3-in. redwood. It has been in service for 14 yr. and is in good condition. The tank handles semi-bleach and natural stock. The stock includes chlorine. Temperature of the solution is maintained at 70 deg. F. The tank was not lined originally, but after six years of service the interior showed a slight softening due to the action of the chlorine. The tank was then lined with lead and is still giving good service.

Another company, a manufacturer of knit goods underwear has seven wood tanks made of 3-in. cypress. The inside dimensions are 9 ft. 9 in. long, 6 ft. 4 in. wide, and 4 ft. 2 in. high. The solution carried contains 3 percent available chlorine. Temperatures range from 70 to 212 deg. F., the maximum temperature being maintained for 4-6 hr. daily. The tanks have half-round ¾-in. brass hoops and ⅞-in. brass stay rods. Cotton knit goods are bleached in these tanks with chlorine and neutralized cloth with sulphur dioxide gas. The front part of the tubs disintegrated first because the bleach solution was added at that point. It has been suggested that when replacements are made thicker lumber be employed on the front of the tanks.

How would YOU protect this outdoor hot line?



Here's the problem: An 8" line carrying saturated steam at 250° F. is insulated with 85% Magnesia covering. The line is outdoors and exposed. The plant is located in the Midwestern section of the country. What method would you use to protect the insulation against the weather?

☐ PAINT? ☐ ROOFING PAPER? ☐ METAL JACKET?

The method to use depends upon geographical location and job conditions. In climates where weather conditions are very severe or on jobs where the insulation is subject to possible abrasion, extra protection is often necessary.

Painting directly over factory canvas, even with a weatherproof paint, does not provide sufficient protection for outdoor work. A layer of weatherproof paper is considered by most engineers to be practical for a majority of weather conditions. Or this type of weatherproofing can be used even in severe climates if the line is not subjected to other sources of possible damage. The paper should be securely wired in place with the lap at the side so as to form a watershed, and all joints should be sealed tightly with asphalt emulsion.

For outdoor lines that are exposed to bumping or abrasion, or to unusually severe weather, such as hard hail storms, the additional protection of metal jackets is often worth while. Metal jackets also are used in refineries and chemical process plants because the metal will not absorb inflammable gases and create a fire hazard.

Choosing the right method when there are several alternatives results in a superior insulation job. And Armstrong engineers have been trained to distinguish the relative merits of such possible close decisions. The same careful attention to all phases of the job—engineering, supervision, and workmanship — characterizes Armstrong's Contract Service. The next time you have a heat insulation job, talk it over with an Armstrong engineer in one of the offices listed below.

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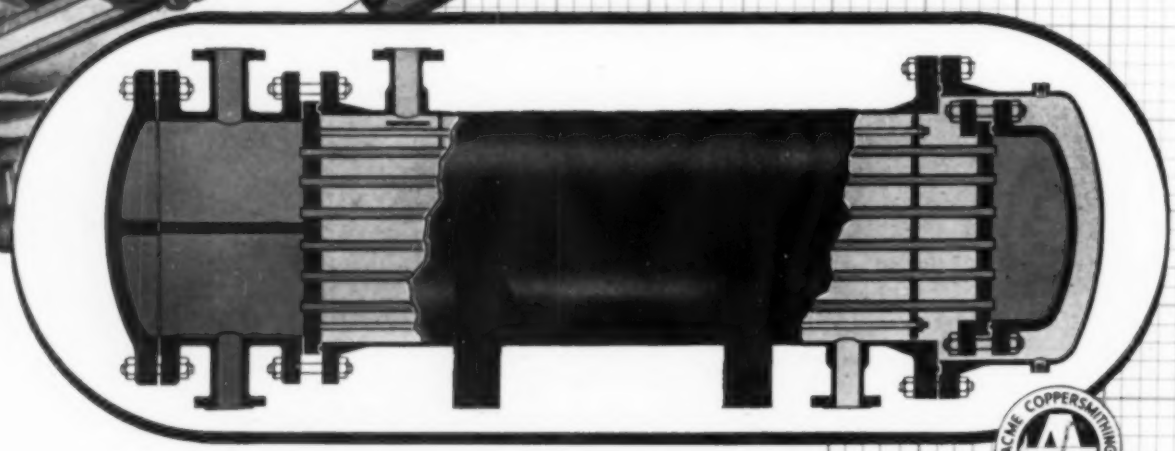

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Regardless of their specific application, all Acme Heat Exchangers are made to minimize, and in many instances to eliminate, fouling and clogging. They are fabricated to prevent leakage and contamination. Acme's complete service includes designing, engineering, fabrication and installation.

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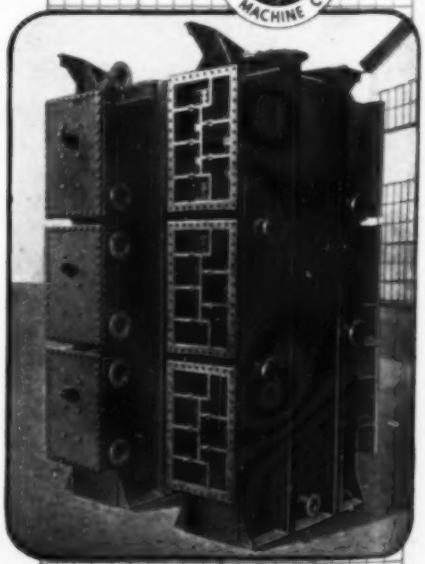
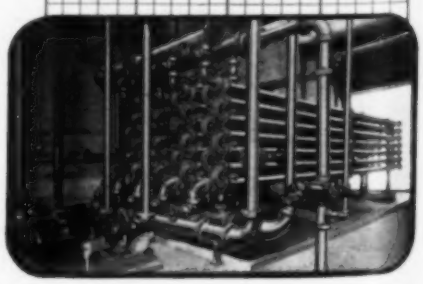
MECHANICAL STANDARDS: Acme Heat Exchangers are fabricated in accordance with A.S.M.E. Code, A.P.I.-A.S.M.E. Code, or T.E.M.A. Standards.





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FROM THE LOG OF EXPERIENCE

Dan Gulleben, ENGINEER

THE SUGAR SURPLUS was so great in 1930 as to depress the price to a level that threatened bankruptcy to large producers. Congress promulgated a new tariff under which Cuban 96-percent raw sugar was dutiable at $40 per short ton, being $10 below the full duty collected on imports from non-preferred countries. At the same time a tariff was imposed on mixtures of raw sugar and water. When the density of this mixture was below 50 Brix (i.e., about 5 lb. of sugar per gal.), the tariff was fixed at one quarter cent per gal., which the Congressional mind may have visualized as a stimulant for increasing the production of alcohol and dry ice. The tariff on a 500,000-gal. cargo of 48 Brix sirup from Cuba would thus be $1,250 compared with $50,000 if evaluated as sugar. This had alluring prospects which Uncle Sam's nephews could be depended upon to exploit.

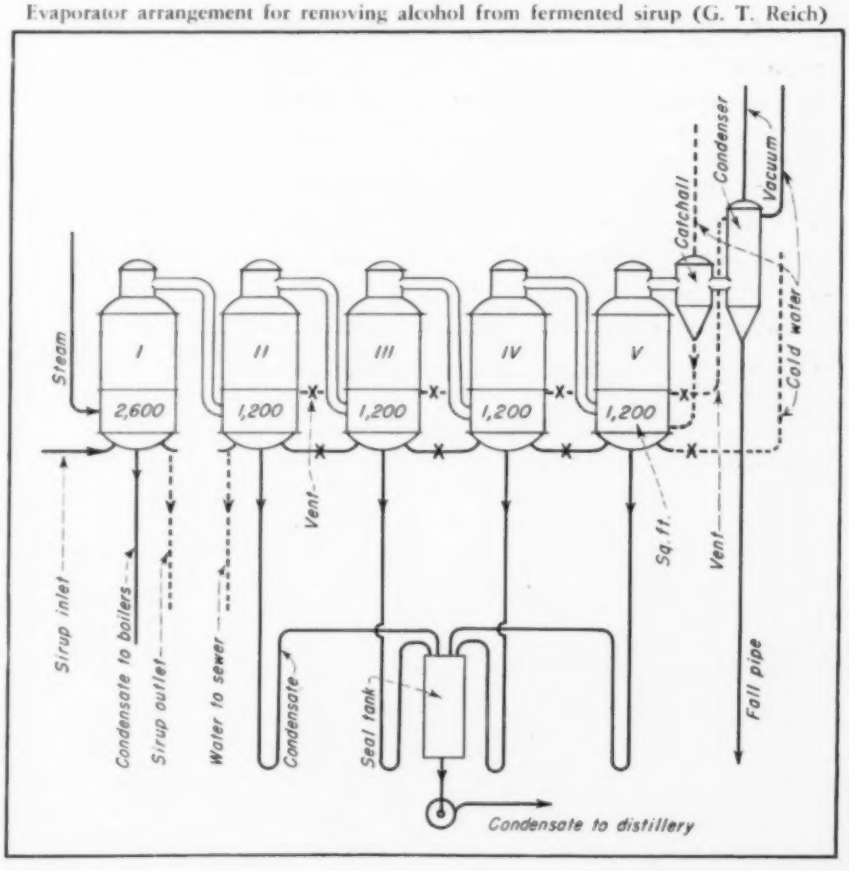
THE "OLD MAN" called the Congressional Tariff Committee's attention to the fact that if the dilute solution could be transported without too much inversion and subsequent fermentation, the intent of the tariff law would be almost voided. The newspapers announced that the $120,000,000 annual revenue from raw sugar imports could thus be reduced to $2,200,000. A West Coast sugar refiner submitted an elaborate report to the Committee setting forth methods of procedure including the proposition of shipping the sirup at 70 Brix and manipulating it with water to 48 Brix just before the twelve-mile limit is reached. The ship would then make a dash for the refinery and the sugar would be extracted before inversion could progress appreciably. The Committee shrugged its shoulder.

HAVING INFORMED the Committee of his intention, the Old Man dispatched a tanker to Cuba for a 350,000-gal. cargo. He sent chemist Harvey ahead to direct the procedure and subsequently to sit on the deck of the returning tanker with a supply of lime, formaldehyde and HTH to restrain inversion if possible. By the time the ship arrived at home, foam and CO_2 were oozing out of the deck manholes and fermentation had evolved alcohol in the sirup. In anticipation of this, a quintuple effect sweet water evaporator had been prepared with some piping alterations as shown. The sirup passed through the first effect where it was rapidly heated to the boiling point, pasteurized (to check fermentation), slightly concentrated and freed of its alcohol content, and then delivered to the molasses storage tank for distillery supply. Cold water entered by way of the liquor outlet of the 5th effect, flowed successively through the liquor spaces of the 4th, 3rd and 2nd effects and thence out of the old liquor inlet to the sewer. The last four effects thus served as a four-stage condenser. The vapor from the first effect was condensed in the 2nd and so on. The condensates containing the alcohol were delivered to completed fermenters and pumped with the wort into the still. The operation of pumping the sirup through the evaporator required one day and one night.

IN THE GLOOM of low twelve, the watchman at the condensate pump stooped to tighten the stuffing box and thus got a whiff of the potency of the water. In an unbelievably short time a line of sugar craftsmen formed at the pump bearing milk bottles, lunch pails and even felt hats. The happy condition, however, was short lived as the end of the cargo had been reached by the time the discovery was made and a rumor had gone forth that the chief had just arrived at the front gate. As a producer of profit the operation was a flop but the byproduct alcohol and dry ice reduced the cost of the experience sought.

CURIOSITY could not be satisfied by half facts and so the Old Man sent the

Evaporator arrangement for removing alcohol from fermented sirup (G. T. Reich)



tanker to Cuba for another cargo. This time about half the sirup was loaded at 46½ Brix and the remainder at 66. The raw sugar was affined before melting. When the tanker got within two days of the home breakwater, the thick sirup was manipulated with water from the ships's tanks to 48 Brix. Under Harvey's accumulated experience both the thin and the thick sirups arrived in good condition. The cargo was promptly entered into the refinery melter along with enough affined raw sugar to reach the usual 65 Brix.

THE PROFIT was not spectacular but the possibitilies glittered. Then the Old Man exposed the facts to the Committee and sat back while the Savannah refinery prosecuted a test case. They imported nine drums of 48 Brix sirup well doctored with chlorine and paid a duty of $1.68 thereon. The duty on sugar basis would have been $116. After a considerable lapse of time the court set a date and declared that after that date the sirup would be dutiable as sugar. There wasn't enough time left to get another cargo before the deadline. The prosecuting attorney threw out his chest and proclaimed that he, single handed, champion of the "peepul," had frustrated the evil intent of the malefactors!

During the War, and some time previously, when the demand for industrial alcohol was very great, the difficulty of importing sugar for alcohol without prohibitive tariff was overcome by inverting the sirup in Cuba before export. Uncle Sam trusted his nephews with this sirup as invert cannot be converted into sucrose, and alcohol cannot escape from the distilleries which are licensed and closely guarded by U. S. revenue officers.

THE PHILIPPINE LIBERATION in 1898 threw upon the Army the task of cleaning up the Islands and teaching the heathen how to work. A tough Scotch ex-sergeant was foreman in an organization approximately similar to the late WPA and he won a reputation of superior accomplishment with material far below par. On the other hand the foreman of a neighboring camp achieved mediocre results although he used the same volume of profanity. The Scotch sergeant however instead of cussing his men, cussed his bad luck, the poor equipment and in fact every thing but the men. Among the jobs was an I-beam bridge of 40-ft. span, designed to shorten one of their "cow paths" by a half hour's journey. When the job appeared to be nearing completion, burro carts began forming in line on both sides. By the time traffic was given the green light there were at least 50 carts with

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Hydrogenated glyceride oils may exhibit a wide range of characteristics in plasticity and keeping-quality because of the many ways hydrogen combines with unsaturated portions of fatty acid radicals present.

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burro and driver on each side, some of which had been in line three days and nights in their eagerness to save a detour of 30 minutes.

RIGGER BILL possessed so great a degree of skill as to make him indispensable in spite of a certain upsetting weakness. Every morning he came to the job with a quart of whiskey on his hip and an unknown amount within. The boss occasionally fired him but each time retracted. Once aloft, Bill's wobbliness disappeared and erection proceeded with dispatch. He even enjoyed his midday siesta stretched out on some beam or plank high above the ground. When plant operation began, Bill was a past master. Every morning he cached his quart in some dark corner for convenient reference. One day the superintendent determined to make an example of him. He saw Bill hide his bottle near the melter. Examination showed that the bottle was full and the seal intact. All day the super and his assistant watched and when Bill checked out, the bottle was still there but it was empty. A few years later the boss fired him. The sudden discharge provided the shock that cured him. He transferred his boundless energy to a job in the U. S. Department of Agriculture soil conservation department and thereafter performed with great satisfaction.

THE MOLASSES tank farm was subjected to playful kids and an occasional marauding derelict who baled blackstrap through the roof manholes by the dark of the moon during the Volstead era. The monkey instinct of the kids was promoted by the presence of the ladders. The 100-ft. circles, without railing, 60 ft. above the ground provided a fine race track. The four tanks were near enough together so that the kids could negotiate the gap by a running jump. However we had an aversion to dead kids and so we surrounded the farm with a corrugated steel fence having the top edge cut sawtooth fashion and having a row of ¾-in. steel bars at 6-in. c. to c. driven into the ground just inside of the fence. This did not stop the kids but smearing of the tanks with molasses ceased. It was not possible to build a fence that the kids could not scale so we built a baseball field in the empty lot behind the tanks and provided some benches and a back stop built of heavy discarded planks securely spiked to the posts. This was effective except that in the course of the cold winter the wood disappeared. In the spring we substituted a steel frame covered with heavy mesh. The mesh satisfied the instincts and kept the monkeys off the tanks.

NAMES IN THE NEWS

G. B. Armstrong

R. H. Noel

H. D. Holler

George B. Armstrong has been named manager of the carbon dioxide division of The Mathieson Alkali Works, succeeding **Charles T. Longaker**, resigned. He is now located at the Mathieson main offices in New York.

John P. McWilliams, Cleveland industrialist, has been elected to the board of directors of Union Carbide and Carbon Corp.

Glenn S. Watson has been appointed chief chemist of the Marietta, Ohio, works of the Calco Chemical Division, American Cyanamid Co.

Melvin E. Clark, director of market research Wyandotte Chemicals Corp. and former assistant editor of *Chem. & Met.*, will after March 1 become manager of caustic soda, soda ash and bicarbonate sales for Wyandotte's Michigan Alkali Division.

Richard S. Shutt is now director of research for Foote Mineral Co., Philadelphia.

Webster N. Jones, director of the College of Engineering, Carnegie Institute of Technology, and **August C. Klein**, engineering manager of Stone & Webster Engineering Corp., received honorary doctor of engineering degrees from Stevens Institute of Technology on February 1.

Armand J. Abrams is now a chemical consultant to the research department of the Koppers Co. in Pittsburgh.

Roland H. Noel has been appointed director of control for Bristol Laboratories, Inc., Syracuse, N. Y. Mr. Noel, who joined Bristol last year, was formerly chief control chemist at Burroughs-Wellcome Co. in Tuckahoe, N. Y.

L. F. Dobry is now with the De Leuw, Cather and Co., consulting engineers of Chicago, Ill., as chief chemical engineer. He had been formerly with Johnson and Johnson.

Vannevar Bush, president of Carnegie Institution of Washington, and wartime director of the Office of Scientific Research and Development, was 1946 winner of the Hoover Medal, jointly awarded by AIEE, ASCE, AIME and ASME. It was formally conferred on Dr. Bush January 20 in New York.

M. L. Crossley, director of research, American Cyanamid Co., with headquarters at the Calco Chemical Division, Bound Brook, N. J., has been unanimously selected to receive the 1947 gold medal of the American Institute of Chemists.

Frederick D. Schreiber, formerly general superintendent of the Pittsburgh Coke & Chemical Co. at its Neville Island operations, has been made manager of the coal chemicals division.

G. Bosschieter has joined the R. M. Hollingshead Corp., Camden, N. J. as technical director of the coating division.

Homer D. Holler, one of the leading authorities in the field of underground corrosion, has been appointed to the staff of the National Bureau of Standards. Dr. Holler will work with Dr. I. A. Denison of the underground corrosion section. He joins the Bureau's staff from the Westinghouse Electric Corp. where he has been responsible for corrosion investigation and control since 1929.

Stuart L. Parsons has been appointed chief engineer for the tungsten and chemicals division of Sylvania Electric Products at Towanda, Pa. In the newly created post Parsons will direct divisional engineering including research and equipment design for the production of tungsten salts and fluorescent powders.

Joseph E. Bludworth, director of petroleum chemicals research and development of Celanese Corp. of America, has left Celanese to establish offices in Corpus Christi, Tex., as an independent consulting engineer to the petroleum and chemical industry.

H. K. Dice and **Vincent T. Anwyll** have been promoted by Celanese Corp. of America. Mr. Dice has been moved from the Chemcel plant at Bishop, Tex., to the Celanese Research Laboratory. Mr. Anwyll has been made production superintendent at Chemcel.

Chester K. Rosenbaum has been appointed research manager in charge of

the semiworks process development and product development sections of the Du Pont plastics department. **Edward B. Cooper** is new research manager in charge of the physics and analytical sections.

H. Martin Friedman has been appointed research director in charge of the development and application of new synthetic chemicals for the textile division of Emkay Chemical Co., Elizabeth, N. J.

Fraser M. Moffat, Jr., is now manager of the export department of the Calco Chemical Division, American Cyanamid Co. it has been announced.

Henry P. Reid, assistant to president, has been appointed chief engineer of the Universal Atlas Cement Co.

Joseph S. Bates has been elected president of Ciba Pharmaceutical Products, Inc., of Summit, N. J. Dr. Bates succeeds **J. J. Brodbeck**, who recently resigned as president to return to Switzerland to take up his permanent residence there.

Ben Wilcoxon, formerly in charge of plant facilities for the Chemical Division of WPB and since June 1945 a technical investigator in Frankfurt and more recently at Karlsruhe, Germany, for FIAT, sailed for the United States, February 15. He will return to his home in Grass Valley, Calif.

John R. Callaham, Pacific Coast Editor of *Chemical Engineering*, has been elected chairman of the Northern California chapter of the American Institute of Chemical Engineers.

A. H. Tenney has returned to the New York offices of Carbide and Carbon Chemicals Corp. as a technical representative for the fine chemicals division. He will specialize in the development of markets for new chemicals being developed by the research laboratories. Dr. Tenney has just completed three and a half years with the Manhattan Project at Oak Ridge, Tenn., and was previously associated with Carbide and Carbon in a sales development capacity.

James T. Power has been appointed director of the development department of Atlas Powder Co., succeeding **W. E. Fletcher**, who retired on February 1. Mr. Power continues to direct sales research activities, which he has headed since October 1943.

Frederick C. Abbott has been appointed manager of labor and personnel relations for the Pennsylvania Salt

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Stainless Steel tubing assures freedom from contamination and protects product quality in this sanitary evaporator, made entirely of Republic ENDURO Stainless Steel.

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Manufacturing Co. Before his new appointment, Mr. Abbott was assistant production manager. Previously, he was manager of the new products division.

Frank Austin Lidbury retired January 30 as president, treasurer and general manager of the Oldbury Electro Chemical Co. of Niagara Falls. He was succeeded by **Walter Wallace** who has been vice president and assistant manager.

Harry B. Cummings has been appointed manager of the tar department of the tar products division of Koppers Co.

Walter L. Sturtevant has retired from his position as chemical engineer at the Manhattan Rubber Division plant, Raybestos-Manhattan, Inc., Passaic, N. J.

Frank L. Magee, general production manager for Aluminum Co. of America, has been made a vice president of the company.

F. R. McMillan, director of research of the Portland Cement Association's scientific research staff since 1927, has been promoted to be assistant to the vice president for research and development. **H. F. Gonnerman**, manager of the Association's research laboratory in Chicago for the past 19 years, is now director of research and **William Lerch**, senior research chemist in the Chicago laboratory since 1940, was promoted to be manager of the department of applied research.

Robert A. Kemmerer has joined Bristol Laboratories Inc. penicillin plant as head of the engineering and maintenance division.

L. E. Van Sickle, head of the kraft paper department of West Virginia Pulp and Paper Co., retired last month after 45 years' service with the company.

Charles M. Slack has been appointed director of research for the Westinghouse Lamp Division. Dr. Slack succeeds **Harvey C. Rentschler**, who is approaching retirement and who will devote himself to completing certain research projects in addition to serving in an advisory and consulting capacity.

Robert L. Richards has been appointed assistant general manager of the rayon department of E. I. du Pont de Nemours & Co. A series of other personnel changes in that department has been announced. **Willis Shackelford**, manager of the acetate division, succeeds Mr. Richards as an assistant

manager of the department. **G. W. Filson**, assistant manager of the rayon division, succeeds Mr. Shackelford, as manager of the acetate division and **George E. McClellan**, director of production of the rayon division, succeeds Dr. Filson. Mr. Richards succeeds **Charles A. Cary** who was elected a vice president, director and member of the company's executive committee in December.

L. A. Mikeska, of the chemical division of the Standard Oil Development Co. is now senior research associate. The title awarded Dr. Mikeska is one that will be given from time to time by Standard to those who merit it as part of a system to give greater recognition to noteworthy technical achievements by its staff.

Robert C. Lyon, formerly service superintendent at the New Brunswick works of the fine chemicals division of the organic chemicals department of E. I. du Pont de Nemours & Co., has been appointed manager of the works. He succeeded **Frank A. Canon** who retired January 1.

Frank H. Ernst is now director of production of the rayon division of E. I. du Pont de Nemours & Co. He succeeds **George E. McClellan** with whom he served the last two years as assistant director. Mr. McClellan was recently appointed assistant manager of the division.

OBITUARIES

Arthur F. Wirtz, 46, secretary-treasurer of the Atlas Mineral Products Co., died suddenly of a heart ailment December 16.

William C. Kabrich, 51, retired brigadier general of the CWS and plant manager of the Morristown Branch of the Flintkote Co., died in Cedar Knoll, N. J., last month.

Maurice E. Lyons, 77, president of the J. H. Day Co., Cincinnati, died January 4.

William E. Hartman, 72, consulting engineer with the Wilputte Coke Oven Corp. died in New York January 13.

Richard W. Levenhagen, 66, chairman of the executive committee of the Glidden Co., Cleveland, died January 17.

Elmer S. Johnson, 46, an assistant treasurer of the West Virginia Pulp and Paper Co., died in New Rochelle, N. Y., January 24.

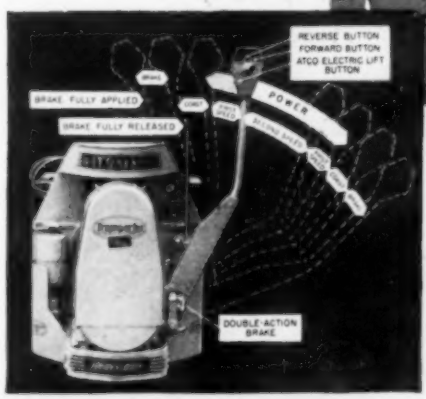
Announcing The New 1947 "Transporter with

ATCO ELECTRIC LIFT

Proved by exhaustive tests to be the fastest and easiest operating motorized hand truck ever developed—the 1947 TRANSPORTER is the first motorized hand truck with electric-lift so efficient it uses a standard 11-plate battery—which makes it the lowest operating cost electric-lift hand truck you can buy.

"Automatic" engineers through intensive research have developed an electric-lift motor and hydraulic pump, which uses less current than the reserve left in the famous TRANSPORTER standard battery at the end of a full day's operation. Therefore, the TRANSPORTER still provides maximum power for a full day's hauling and yet uses only a light socket for charging battery.

A simple pressure of the forefinger on the new ATCO ELECTRIC LIFT BUTTON raises the loaded skid or pallet to moving height in SECONDS! In a normal day's operation, less than 10% of battery capacity is used to lift to maximum height—and since the lift is not always raised more than half the full height in actual work, the current consumption will be less.



Muscle Mike is the mighty midget of power in the TRANSPORTER that gets your material where you want it with new ease and lowest cost. Diagram shows how IN ONE MOTION and WITH ONE HAND, operator effortlessly controls every movement of your product with new ATCO ELECTRIC LIFT Model TRANSPORTER.

REVERSE BUTTON and guide handle eases Transporter below skid or pallet, and load is ready to be raised to moving level. Requires no skill, no muscle work—just thumb pressure.

FOREFINGER PRESSES the ATCO Electric Lift, and your material is raised, ready to move. Human energy expenditure: practically nothing.

FORWARD BUTTON starts the load—4000 to 6000 pounds of materials glide along at safe walking speed. You deposit it with the same easy "touch-of-the-fingers" control.

ONE HAND, ONE MOTION OPERATION

New double-position brake—applied either by raising or lowering guide handle, provides steering and braking leverage at the same time for hauling on ramps. All controls—forward and reverse speed, lift, steering and brake are so arranged they may be regulated by one hand and operated in one motion, simply by touching the buttons and guiding the handle.

Available in three standard units, 4000 and 6000 capacity platform model and 4000 pound capacity pallet model. TRANSPORTER also comes in companion models equipped with the ATCO Foot Lift at lower cost. Let an ATCO SPECIALIST show you how TRANSPORTERS end back-breaking, gruelling toil, release critical labor for more productive work, cut your material handling costs in half! Mail the coupon for complete facts. No obligation.

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( ) Have an ATCO Specialist survey my handling costs.

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INDUSTRIAL NOTES

Borg-Warner Corp., Chicago, is increasing its Marbon Corp. production capacity by the erection of four new plant buildings at Gary, Ind.

Young Radiator Co., Racine, Wis., has added the Carl H. Roath Co., Denver, to their list of distributors.

General Mills Inc., Minneapolis, Minn., has named Sewall D. Andrews, Jr., vice president of the chemical division.

International Nickel Co., Inc., New York, announces H. J. French named assistant vice president of the International Nickel Co. of Canada, Ltd.

Mixers Inc., Philadelphia, is the new name of the Hottman Machine Co.

Sun Tube Corp., Hillside, N. J., announces that John H. Friden, vice president and a director of the company has been made executive vice president; and R. Smith Schenk has been elected vice president.

Farrel-Birmingham Co., Inc., Ansonia, Conn., has appointed Arthur B. Pike Boston area representative. His office is at 1736 Massachusetts Ave., Lexington, Mass.

Athol Manufacturing Co., Athol, Mass., has made Robert M. Tyler sales manager.

American Cyanamid Co., New York, has created a new sales unit, the rubber chemicals department, at the Calco Chemical Division in Bound Brook, N. J. The rubber chemicals department of the American Cyanamid Co. has been merged with the new Calco sales unit. Bancroft W. Henderson, manager of the rubber chemicals department, American Cyanamid Co., has been named to head the new Calco Department.

Johns-Manville Corp., New York, has begun construction of the second and main units of its research center near Bound Brook, N. J.

General Electric Co., Pittsfield, Mass., has changed the organization of the chemical department by establishing the plastics division and the compound division in place of the former plastics divisions. George P. Lehmann will manage the plastics division and John

L. McMurphy the compound division. Both men will make their headquarters in Pittsfield.

American Chemsol Corp., Coraopolis, Pa., is a new firm producing industrial solvents and thinners. The president of the company is Leonard Messer.

E. I. du Pont de Nemours & Co., Arlington, N. J., has appointed W. D. Maginnes sales manager for the nylon monofilament section to succeed W. W. Perry.

Watson-Stillman Co., Roselle, N. J., has selected C. Huizing as New England representative.

Interchemical Corp., New York, has elected Ernest W. Pittman to the new office of chairman of the executive committee. Herbert B. Woodman succeeds him as president.

Liller, Neal & Battle, Atlanta, has moved from the Chamber of Commerce Bldg. to the Walton Bldg.

Ladish Co., Cudahy, Wis., is the new name for the Ladish Drop Forge Co.

Weston Electrical Instrument Corp., Newark, N. J., has appointed John H. Miller vice president and chief engineer. He succeeds W. N. Goodwin, Jr.

Falleen Drop Forge Co., Inc., Philadelphia, announces the appointment of R. J. Swing as director of sales.

Tube Turns Inc., Louisville, Ky., has added Donald A. MacNeil to the sales staff of the forging division. His headquarters will be in the Utilities Bldg., 327 South LaSalle St., Chicago.

Hewitt- Robins, Inc., Buffalo, N. Y., and Mc Kiernan-Terry Corp., Harrison, N. J., have announced an agreement under which Mc Kiernan-Terry acquires the Robins Conveyors' Mead Morrison division.

Fairbanks, Morse & Co., Chicago, has appointed John S. King manager of the Chicago branch to succeed Frank V. Roy who retires on March 1.

Borden Co., New York, has appointed A. M. Freeman director of technical service of the Casein Co. of America, division of the Borden Co.

Nichols Engineering & Research Corp., New York, announces the appointment of F. B. Schilling, vice president, as vice president in charge of sales and general manager; R. W. Rowen, vice president, as vice presi-

dent in charge of engineering and research and S. Burgess as vice president in charge of field operations.

Standard Oil Co. (Indiana), Whiting, has consolidated the light oils projects group and heavy oils projects group of the Whiting refinery. The groups will be known as the projects division. R. T. Myrick will direct the activities and Roy Diwoky will be superintendent.

Bemis Bro. Bag Co., St. Louis, has announced the opening of a sales office at 6070-71 Jenkins Arcade, Pittsburgh, under the management of Ellis H. Deitrick.

Monsanto Chemical Co., St. Louis, has named Dan J. Forrestal, Jr., assistant to the director of industrial and public relations.

Warren Steam Pump Co., Warren, Mass., announce that the Parkman A. Collins Co., has been appointed the authorized district agent in the territory formerly handled by the Boston office. The address remains the same.

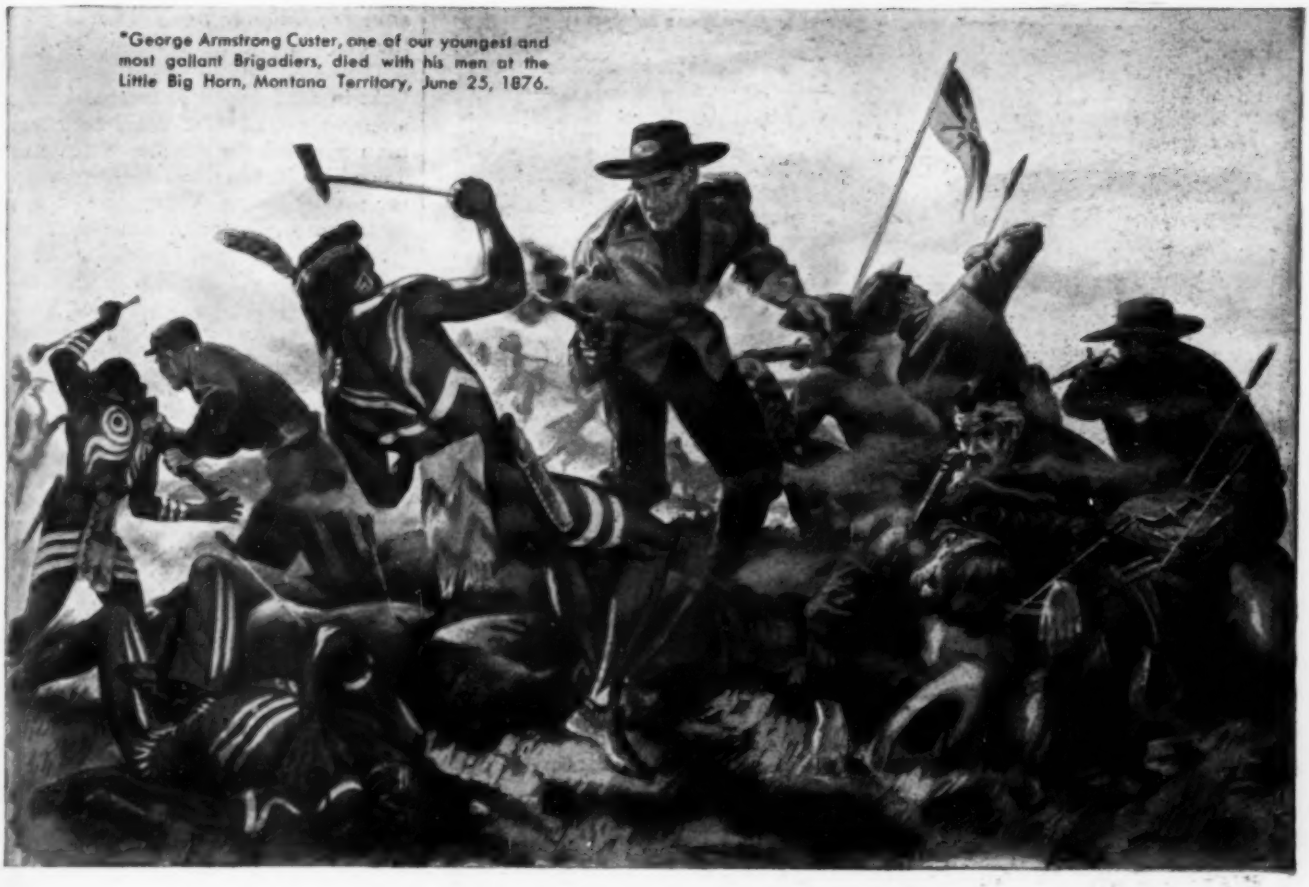
Thomas C. Wilson, Inc., Long Island City, N. Y., appointed the Harang Engineering Co., 840 Lake St., San Francisco, its representative in the northern California area.

Carbozite Protective Coatings, Inc., Pittsburgh, formerly known as Carbozite Co., have moved to their plant at 811 South Main St., Greensburg, Pa.

Darsyn Laboratories, Paterson, N. J., has elected W. M. Stieh president. The company is affiliated with the Metalsalts Corp., Paterson. Dr. N. Grier will be in charge of all research work and C. Casalbore in charge of production.

E. I. du Pont de Nemours & Co., Wilmington, has announced four organizational changes in the nylon division. Truman C. Welling, district sales manager at Charlotte, N. C., was appointed sales manager in Wilmington. P. D. Atwood, district sales manager at New York, is now promotion manager in Wilmington. A. J. Smith, Jr., promotion manager, succeeds Mr. Atwood at New York. David B. Hardin, of du Pont's rayon division in New York, succeeds Mr. Welling at Charlotte.

Monsanto Chemical Co., Springfield, Mass., has appointed Carl F. Graesser sales manager of thermosetting molding materials for the company's plastics division. He will be succeeded as assistant sales manager by C. L. Rich-



*George Armstrong Custer, one of our youngest and most gallant Brigadiers, died with his men at the Little Big Horn, Montana Territory, June 25, 1876.

29 Years Before Custer's Last Stand* . . .

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This experience is important to you because it assures you better containers for your products. It'll pay you to check with your Chase Salesman, for Chase makes bags of all kinds—each container specifically designed for more economical and more efficient packing of *your product.*

Remember, for Better Bags . . . better buy Chase. It's more than a slogan, more than a catch phrase—it's your positive assurance of an improved container.

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ards, Jr., formerly branch manager of the division's St. Louis office.

Cal-Fin Co., South Pasadena, Calif., announces that new equipment has been installed for the manufacture of Tilco-Fin heat transfer tubing as developed by Extended Service Division of David E. Kenney, Inc., Brooklyn, N. Y.

Container Testing Laboratories, Inc., Los Angeles, has opened an office at 9047 Wilshire Blvd., under the direction of Leo M. Smith, who for many years was associated with Fort Wayne Corrugated Paper Co.

Hyster Co., Portland, Ore., has named Ray Ronald as western division sales manager at Portland. V. G. Lindenberg has been appointed industrial lift truck manager at the Seattle, Wash., office.

R. M. Hollingshead Corp., Camden, N. J., has added Clarence D. Kirkeby to the coating division.

Dow Chemical Co., Midland, Mich., announces personnel changes in New York and Chicago. Frank L. Brown of the New York office will supervise plastics sales in the eastern region which includes Boston, New York and Philadelphia. Gage Olcott is in charge of plastic sales in New York. Joseph E. Russell directs plastics sales in the midwest region including Cleveland, Detroit, Chicago and St. Louis offices. Floyd J. Gunn heads plastics sales in Chicago.

Sun Oil Co., Philadelphia, has appointed Laurens H. Fritz as industrial advertising manager.

Joseph T. Ryerson & Son, Inc., Chicago, named Park Sanderson manager of the Boston plant. He succeeds Herbert C. Wills, who is retiring.

Austin Co., Cleveland, has elected Harold A. Hallstein to the new post of executive vice president. Two new members of the board of directors are Laurence E. Cooney, vice president and general manager of sales, and Harold A. Anderson, vice president and eastern district manager.

Babcock & Wilcox Co., New York, has moved the Babcock & Wilcox Tube Co., Los Angeles office from the Banks Huntley Bldg. to Petroleum Bldg., 714 West Olympic Blvd.

Hilliard Corp., Elmira, N. Y., has appointed S. L. Powers, 606 Williamson Bldg., Cleveland, as their representative.

FOR TEMPERATURES AND PRESSURES

This is the new Brown *Electr-o-Vane* Control Unit. To users of electric contact control Thermometers and Pressure Gauges, it offers a high degree of control performance never before attained.

A true triumph in control, this electronic unit is not merely an adaptation of a known principle but an achievement in design by which all the shortcomings of similar devices are eliminated.

Added to the Brown Thermometer and Pressure Gauge line, the *Electr-o-Vane* Unit provides a control instrument of unequalled performance. No instrument of this type can equal its dependability in service, its precision in operation or its safety features.

Brown *Electr-o-Vane* Thermometers and Pressure Gauge Controllers are available *at no premium cost*. With all the exclusive features of these instruments, why compromise with less than the best.

The *NEW* CATALOG fully describes the operating principle, features and models of the Brown *Electr-o-Vane* Controller. A copy will be sent to you without obligation. Write today for Catalog 6001.

THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Company*, 4478 Wayne Avenue, Philadelphia 44, Pa. Offices in principal U. S. cities and in Toronto, Canada; London, England; Stockholm, Sweden; Amsterdam, Holland.

HERE ARE THE FACTS

The Brown *Electr-o-Vane* Control unit operates on the principle that when a metal vane is interposed between two oscillator coils, the state of oscillation can be made to change or stop in an electronic circuit. This change or stopping of oscillation causes the electronic circuit to operate a load relay.

The oscillator coils are the heart of the controller. Brown oscillator coils are molded in bakelite and are thus *moisture-proof*—an exclusive Brown feature. A knife-edge control action is provided that does not drift. Control action is precise. It never varies. It is unaffected by moisture conditions.

Only the circuit used in the Brown *Electr-o-Vane* Control Unit causes an actual stop in oscillations. That is why this is the only instrument of its type providing real *snap action*—an important factor for precision control.

Brown *Electr-o-Vane* Control is contained in a neat, compact unit. It is self-contained, easily removed as a unit and unaffected by dust or dirt.

Electr-O-Vane

THERMOMETER CONTROLLERS

AND PRESSURE GAUGES

CONVENTION PAPER ABSTRACTS

CONTENTS

FISCHER-TROPSCH COMPLICATIONS

FLOW diagrams do not illustrate vividly enough the tremendous amount of equipment required in the conventional German Fischer-Tropsch process. The Merbeck plant, for example, having an installed capacity of about 1,500 bbl. per day of total product had 11 gas preparation units covering 2½ acres of land, and in addition: 4 parallel sets of hydrogen sulphide removal towers each 30 ft. high by 35 ft. in diameter; 5 parallel sets of organic sulphur removal towers 30 ft. high and 12 ft. in diameter; 100 Fischer-Tropsch reactors, each 8x10x15 ft. in size; 2 adsorption systems each containing 7 towers; 2 stabilization systems; and 2 distillation plants.

Heart of the Fischer-Tropsch plant is the synthesis chamber and nothing shows the complexity of the German process more than this section of the plant; 100 of these are required for 1,500 bbl. per day capacity. These chambers are small and complicated, designed to remove the enormous heat of reaction which is about 7,000 B.t.u. per lb. of product. Each chamber consists of an array of metal fins about 0.28 in. apart. Transversely through these fins are cooling tubes about 1.5 in. in diameter through which water flows as a cooling agent. The amount of steam obtained in this manner is practically enough to supply the war requirements of the plant. Catalyst, cobalt-thoria, is packed between the fins.

From these data, it is readily seen that German Fischer-Tropsch plants were quite complex and actually made up of many small units. For example the daily capacity of a single synthesis unit averaged about 15 bbl. which is hardly more than pilot plant size. The plants in general were very sparsely instrumented and necessitated the employment of large operating staffs for

hand control. Such plants are too expensive, complex and too small in unit size to fit in with American standards of petroleum production.

The optimistic tone with which American versions of the Fischer-Tropsch process are discussed today indicate very strongly that these processes have come a long way from the cumbersome and expensive German process.

R. C. Alden, Phillips Petroleum Co., before California Natural Gasoline Association, Los Angeles, Oct. 11, 1946.

PREPARATION OF PHOSPHORS

Although there are naturally occurring minerals which have luminescent properties, most phosphors are prepared synthetically. Carefully controlled chemical purity is absolutely essential in the preparation since the presence of minute amounts of certain elements destroys the luminescent properties. Iron, cobalt and nickel are especially detrimental to the luminous efficiency of zinc sulphide since the presence of any of these elements in concentrations of the order of one part per million decreases the efficiency of the phosphor.

For zinc sulphide phosphors a common method of preparation is to precipitate the sulphide with pure hydrogen sulphide from a solution of a zinc salt. This zinc salt solution is purified carefully by chemical or electrolytic methods before precipitation. Another method of preparation is to fire pure zinc oxide and sulphur together at elevated temperatures. The direct firing method generally is used to prepare zinc silicate (willemite) from zinc oxide and silicon dioxide.

Although careful purification is necessary to remove certain elements which "kill" the luminescence, other elements, called activators or phosphorogens, are added to increase the luminescence or change the color of the emitted light. These activators are added in solution to the zinc salt solutions and then are coprecipitated with the sulphide. When direct firing methods are used a salt of the activator element is mechanically mixed with the other components before the firing operation. For zinc sulphide the common activators are copper, silver and manganese; and the latter is the usual activator for zinc silicate. The amounts of copper or silver used vary from 0.001 to 0.05 percent while the optimum amount of manganese for activating the sulphide or silicate runs about 1 percent. According to modern theory copper and silver atoms go in between the atoms of zinc and sulphur in zinc sulphide, while the manganese atoms substitute for the zinc atoms.

Zinc sulphide, as it is precipitated, does not show luminescent properties;

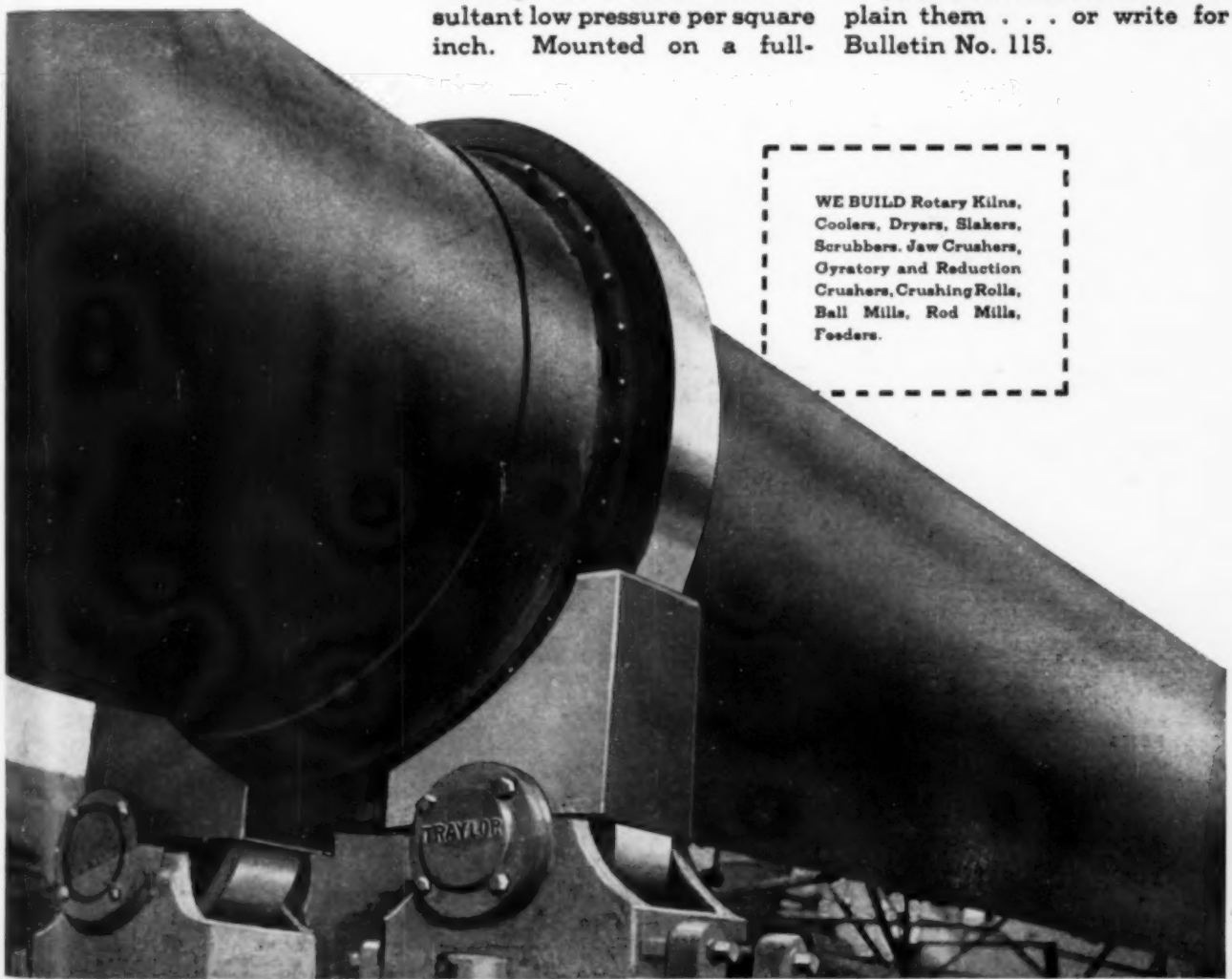
Perfect Alignment

Single Roller Supports Preserve LONG-LIFE EFFICIENCY OF TRAYLOR ROTARY KILNS

The perfect alignment of Traylor kilns is preserved by specially designed single roller supports. Shell strength and rigidity are retained . . . less power is required for operation.

Wide faces of large diameter steel rollers provide generous contact with the riding ring. The roller shafts turn in water cooled, renewable bronze-lined bearings lubricated by automatically circulated oil. The bearings are oversize with resultant low pressure per square inch. Mounted on a full-welded frame of heavy H-beams, these supports are quickly adjusted for perfect alignment on installation and whenever necessary throughout the long life of the kiln. This has assured economical operation and maintenance . . . minimum idle time for every inch of the 45,000 feet of Traylor Rotary Kilns now in use around the world.

Built to fit your individual needs, Traylor kilns present other advantages for your calcining operations. Our representative will be glad to call at your convenience and explain them . . . or write for Bulletin No. 115.



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it is necessary to fire the material at elevated temperatures. The firing operation performs three functions: It determines the particle size, causes the activator to diffuse into the lattice of the host compound, and determines the crystal structure. Phosphors are fired in platinum or porcelain crucibles or in quartz dishes, either exposed to the ordinary furnace atmosphere as in the case of zinc silicate, or covered and in a reducing atmosphere as with zinc sulphide. About 2 to 5 percent of a flux, usually salt, is added to the phosphor before firing.

J. R. Spraul, Armour Research Foundation, before Chicago Section, American Chemical Society, Evanston, Ill., Jan. 24, 1947.

CURARE FOR POLIO SUFFERERS

In this country, chemists are currently investigating curare, the deadly arrow poison of the South American Indians, with an eye to preparing it in pure form. Curare attacks the nervous system, first affecting the muscular action of the neck and then spreading to other parts of the body until finally it causes paralysis of the respiratory system. Prolonged artificial respiration at the final stage enables the victim to live until he has recovered from the effects of the poison.

Just how curare causes its paralysis was not known until recently when it was discovered that the drug temporarily destroys communication between nerve and muscle, although neither is directly affected.

Curare injected along with Pentothal, a sleep-producing drug, has proved to be an extremely effective anesthetic in surgical operations on the head and neck when it is essential that the muscles remain relaxed.

Curare promises to help polio sufferers by relieving spastic twitching. Small amounts of curare tend to block abnormal nerve impulses that cause twitching but do not interfere with voluntary movement.

Donalee L. Tabern, Abbott Laboratories, before the Peoria Section, American Chemical Society, Peoria, Dec. 19, 1946.

MILITARY APPLICATIONS OF ELECTROPLATING

Many thousand dies, gages, molds, forming and cutting tools were plated with hard chromium. Very little bright chromium was employed. Of special interest is the chromium plating of calibre-50 gun barrels. Porous chromium plate was applied to cylinders of aircraft and of diesel engines. Important applications of nickel plating were made for the Manhattan Project. Copper plating was used extensively to protect steel surfaces during case hardening. An important appli-

cation of zinc plating was on steel cartridge cases. Lead took the place of zinc in many applications. Tin plating strip steel saved many tons of tin over and against hot-dipped tin plate. Bearings for aircraft engines were silver plated. Noable are the thin coatings of silver on radar equipment. Large searchlight reflectors were rhodium plated. Anodizing aluminum was carried out on a very extensive scale. Of special interest was the use of indium alloys for corrosion resistant bearings.

These examples, which by no means cover all the military applications of electroplating, illustrate the ability of this industry to adapt its methods and products to meet new and unusual conditions. The interest thereby aroused in plating by both producers and consumers, augurs still further progress in meeting peacetime requirements.

William Blum, Bureau of Standards, before The Electrochemical Society, Toronto, Oct. 16, 1946.

THE HUMAN SIDE OF ENGINEERING

WITHIN the past few years, there has been a sudden and rapidly increasing awareness of the fact that the human side of engineering has been grossly neglected. In retrospect, it is now clear that this neglect has been due to the intense preoccupation with technological problems and to the tacit assumption that the human and sociological problems were of minor consequence or would somehow be worked out in the natural course of events. Since the decisive final events of World War II and the general realization of the tremendous material accomplishments of science and industry, there has been a very general shifting of attention to the notably lagging sociological and political phase of human progress. This new emphasis has been especially evident in three areas in the engineering world:

First, more attention has been paid to the need for greater participation by engineers in civic affairs. There has been widespread insistence upon the necessity for more help from engineers and scientists in matters of public responsibility.

Second, there has been a significant shift in emphasis from the purely technical toward the "humanistic" subjects in the curricula offered by engineering colleges. It is now rather generally recognized that engineering education has not adequately prepared graduates to live interesting, useful lives as members of an increasingly complex society.

Third area wherein the new emphasis upon "human engineering" has become notable is in the industrial world, where the individual engineer

JUDGE A SPEED REDUCER BY EAR?

Your ears can tell you plenty about a speed reducer because there is no normal reason why a modern speed reducer should be noisy. Noise warns you that power transmission is not smooth . . . that wear-causing friction is present.

That's why the quiet operation of Farrel speed reducers is so important . . . so significant. The noise you *don't* hear provides the evidence of precision-generated, continuous tooth herringbone gears, transmitting power in a smooth, quiet, even flow.

The continuous tooth design means that a maximum number of teeth are always in mesh. Overlap or interlacing of teeth, together with gradual engagement, promote smooth operation. Oblique lines of contact and uniformly distributed load eliminate danger of noise resulting at some later date from uneven tooth wear.

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is frequently almost submerged in large corporate organizations. There was a time, not many years ago, when it was generally assumed that if a technical employee was assigned to a job with a reasonably well-defined responsibility at a salary in line with the prevailing level of the industry he could be relied upon to adjust himself to his environment and work out his personal problems with very little further attention from the management. When unmistakable signs of restlessness and discontent began to appear among these young engineers, many of their elders over-simplified the matter by charging it entirely to a desire for higher wages. It has become abundantly evident, however, that the adjustment of the individual engineer to his environment in an industrial organization is quite a complex process, which requires considerable time and cannot safely be left to chance.

W. Julian King, Cornell University, before Conference on Engineering and Human Affairs, Princeton, N. J., Oct. 3, 1946.

USES OF FLUORSPAR

LATEST complete breakdown of fluorspar consumption in the United States is for 1943 and gave the following percentages: Steel industry including basic open-hearth, electric furnace steel and bessemer steel, 60; iron foundries and ferro alloys, 3; hydrofluoric acid and derivatives, 29; primary aluminum and magnesium, 1; and ceramic industries, glass and enamels, 6. This adds up to 99 percent of a total 400,000 tons in round numbers. Miscellaneous industries including cement accounted for the small remainder.

The iron and steel industries are the largest consumers of fluorspar and will probably retain that position for a long time to come but it is interesting to note that whereas, during the period 1922 to 1928 the consumption was about 7.4 lb. CaF_2 per ton of steel, in the period 1939 to 1943 the requirement was 5.8 lb. per ton, a drop of about 22 percent which drop is due to increased operating efficiency.

From the above figures it is evident that the manufacturers of hydrofluoric acid and its derivatives are the second largest consumers and the rapid increase in consumption by that industry during recent war years is indicated by the fact that immediately prior to Pearl Harbor the annual consumption of anhydrous hydrofluoric acid probably did not exceed 15,000 tons, whereas the 1944 consumption of the acid was estimated at about 60,000 tons, and the present consuming capacity of the acid making industry is around 150,000 tons per year.

Fluorine is engaging the attention

Go "National" for Lead VALVES

What kind of Acid Valve do you need?

1 "United" Type R Valve? This ingenious valve, recently introduced by National Lead, offers advantages unobtainable with valves whose body and seat are cast as an integral unit. Because of its split-body construction it can be installed either as a "Y" or Angle pattern. All you do is reverse the position of the body section, as shown in the illustrations below. Thus, your supply stock can be held to a minimum by standardizing on *one* valve with *two* uses. Another feature is the removable seat and plug disc. Both can be replaced easily at nominal cost. Finally, seat and plug can be supplied in any alloy or material you specify. For normal applications, the valve is furnished in three standard ways: 1. Lead plug disc and stem integral; 2. Removable lead plug disc; 3. Removable rubber plug disc.

Two valves in one! *Simply reverse the position of the body sections and the "United" Type R Valve is changed from a "Y" pattern to an Angle pattern. Available in hard lead or lead-lined cast iron or cast steel.*

2 "United" Chem-Rayon Valve? This valve is manufactured in both "Y" and Angle design. The body is cast hard lead. Fins of the same metal reinforce and greatly increase the strength of body and flanges, while holding weight to a minimum. The stuffing box is of exceptional depth. Packing can be replaced under pressure. Steel and bronze bonnet are completely covered (except wheel and bushing) with hard lead. Available with removable plug discs of rubber or lead.

We also supply check, foot and diaphram valves in hard lead, cast iron, and cast steel lead lined.

3 "United" Type C Valve? The important difference between this type and the "United" Chem-Rayon valve is in the materials used for the body and bonnet. In the Type C valve these are made of cast carbon steel or cast iron heavily lined with lead. Furthermore, the body is cast oversize in order to allow a full flow area after lining. All parts of the two valves are interchangeable. Available in both "Y" and Angle patterns.

4 "United" Gate Pattern Valve? This is a most efficient gate valve, available with body and bonnet in hard lead, lead-lined cast steel or lead-lined cast iron. It is designed for use wherever an absolutely drip-proof acid valve is a "must." The seat is hard lead, cast integral with the body lining. This valve can be furnished with disc made of acid-resisting rubber, bakelite, or special alloys as required. You get a satisfactory seal at all times.

No Matter what Your Acid-handling Problem...

Go "National" for Lead

National Lead is ready to consult with you and supply any type of lead pipe...valves...sheet...lead-lined or lead-covered equipment...even complete acid recovery plants. And behind every National Lead product, every National Lead recommendation, are years of experience and many important installations in every field handling corrosive liquids and gases.

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and research on the part of the chemical industry. The fluorination of petroleum oils, the formation and properties fluorocarbons and compounds of fluorine with many organic substances are all subjects of intensive study and research. All of this work is being aided by the production of elemental fluorine by electrolysis.

The market for hydrofluoric acid and its compounds is expanding rapidly due to these and other new uses for new organic derivatives of hydrofluoric acid. One of the very interesting new uses, and a wasting one, is as a solvent and propellant for DDT, dichlorodiphenyl-trichlorethane. Freon, a synthetic organic compound of fluorine and chlorine which is also used as a safe domestic refrigerant, is used as a propellant for aerosol insecticides which are solutions of pyrethrum extract and sesame oil. Freon production capacity is approximately 29,000 tons annually according to estimates and, based on a 90 percent recovery from ores, represents the consumption of about 20,000 tons of acid grade fluorspar.

Roy L. Cornell, California Testing Laboratories, before American Institute of Mining and Metallurgical Engineers, Los Angeles, Oct. 25, 1946.

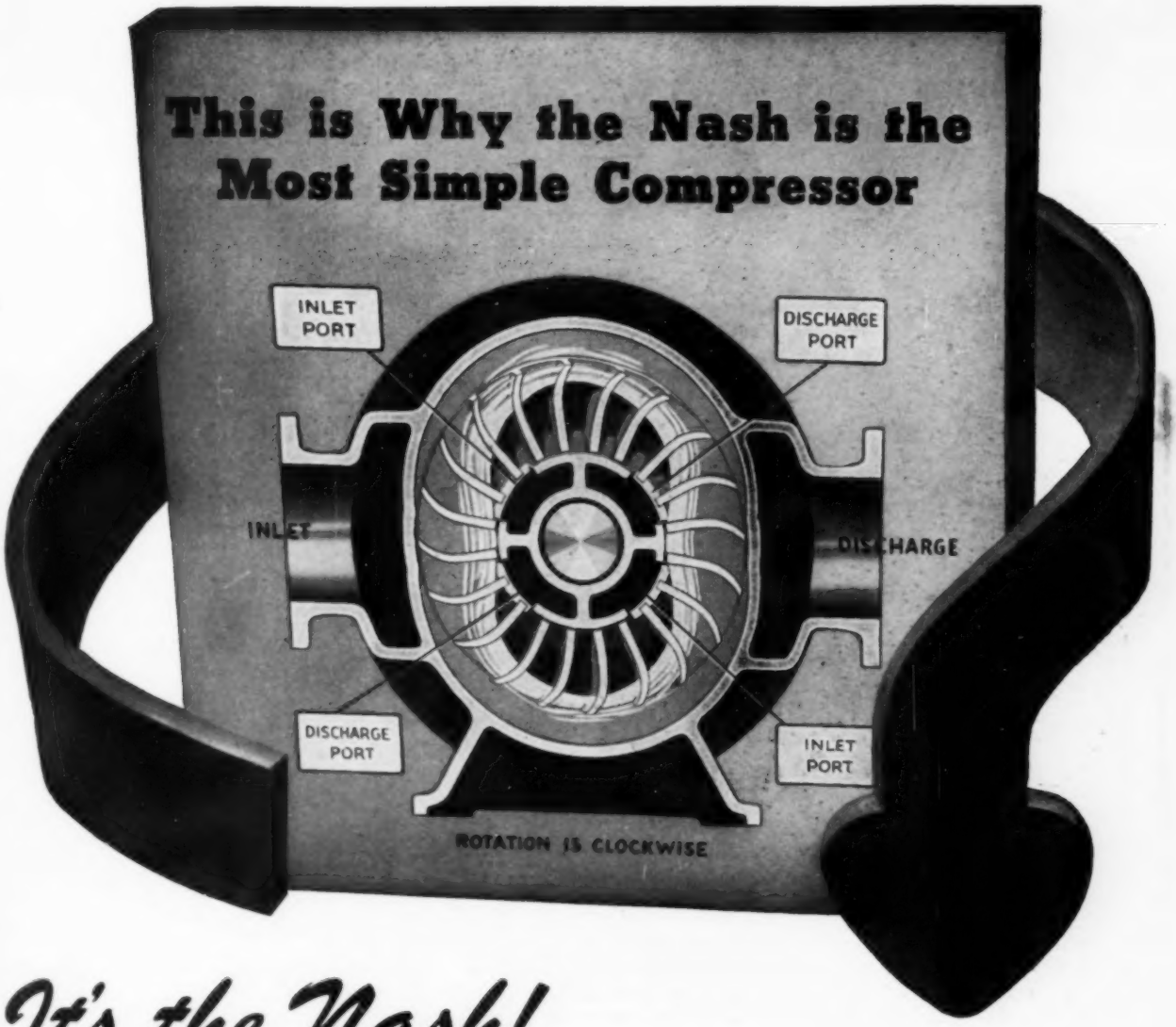
HYDROCARBON PEROXIDES

CONCENTRATED peroxides prepared from selected petroleum fractions and marketed under the name of Uniperox are liquids and contain 60 to 65 percent peroxide. From data supplied by many experiments, it is evident that Uniperox is composed mainly of cyclic hydrocarbon hydroperoxides containing six to eight carbon atoms. For purposes of calculation, the molecular weight may be assumed to be 130, which corresponds to the empirical formula, $C_7H_{13}OOH$.

At temperatures below 90 deg. C. Uniperox is stable; but in the neighborhood of 100 deg. C. the rate of decomposition is approximately one percent per hour. At about 110 deg. C. the decomposition is exothermic and extremely rapid. The rate of decomposition of Uniperox was found to be two or three times that of Uniperox M, a pure peroxide, in various hydrocarbon solvents at 145±1 deg. C. The rates of decomposition were smallest in benzene and greatest in cyclohexene with intermediate rates in *n*-hexane and methylcyclohexane.

In a series of experiments, Uniperox was reduced with ferrous sulphate, sodium sulphite and hydrogen; the main reaction products were mixtures of alcohols. Mercaptans and thioethers reacted readily even in very dilute mineral oil solution. Uniperox has been found to be effective as a polymerization catalyst, and it has been

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request.

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
325 WILSON, SO. NORWALK, CONN.

tested in a number of commercial resins which require peroxide-type catalysts.

Since Uniperox 60 and Uniperox M were found to be effective in increasing the cetane numbers of various iso-octane-cetane numbers, the crude peroxide concentrate has been tested as as diesel fuel additive, known as Union Diesel Additive 698. The addition of 0.5 percent peroxide (0.835 percent of crude 60 percent concentrate) to 25 different diesel fuels raised the cetane number of the fuels from 4 to 13 units, the average being nine. During a storage period of five to seven months, 19 of the 25 fuels containing 1 percent of peroxide (cetane number gain, 12 to 20 units) lost four units or less of this gain.

During this same storage period, the loss of peroxide was in some fuels very appreciable. The loss in the cetane number increase, however, did not vary directly with the peroxide content. Experiments showed that the peroxide decomposition was lowest in the treated samples containing the least amount of sulphur.

Addition of the reaction products of butyl sulphide and Uniperox and alkyl thiophanes and Uniperox to diesel fuels caused an increase in the cetane number of the fuel almost as great as was caused by the addition of an equivalent amount of peroxide. This explains why the cetane numbers of peroxide-doped fuels changed relatively little during storage although an appreciable portion of the peroxide disappeared.

The peroxides have a very favorable effect upon the cold starting characteristics of diesel fuels. No adverse effects such as pitting of injector nozzle caps, valves or seats, or excessive carbon deposits were observed in engines fueled for several hundred hours with Uniperox-doped diesel fuels.

Adalbert Farkas, Andrew I. Smith and Arthur F. Stribley, Jr., Union Oil Co. of California, before the Petroleum Group, American Chemical Society, Berkeley, Calif., Sept. 9, 1946.

EVALUATION OF ABSORBER OPERATING EFFICIENCY

In the classical Absorption Factor Chart of Souders and Brown, upon which almost all industry evaluations of absorber efficiencies have been based, it was assumed that an effective individual absorption factor could be developed which would average out the differences of the L/V and K values throughout an actual column, and that the operation of a column could then be directly related to a parallel-operating theoretical column. Unfortunately, experience has shown that the number of theoretical trays required to match the operation of an

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actual column shifts markedly with the percentage of key components recovered, and that the degree of shifting varies widely for different columns.

In seeking an improvement on the conventional absorber evaluation method, it was concluded that the continued use of the mean absorption factor, based on the recent work of Edminister, offered the best method for correlating the major variables associated with the absorber operation, and that the solution lay in substituting correlation data factors from actual operating data, on a chart, for older theoretically calculated factors.

A special empirical chart was constructed, in which the scale was developed from the operating data of 40 columns, ranging in operating pressure from 35 to 1,800 lb. gage. With this new chart, (1) all component recoveries between 75 and 99 percent plot as a straight line for any given tray as long as its basic tray efficiency remains constant ;(2) all such straight lines, irrespective of number of trays employed or degree of efficiency, can be drawn through a single convergence point for any given absolute pressure; (3) the characteristic operating lines remain fixed for any given column over wide ranges of lean oil temperatures, and for all types of intercooled columns as long as the intercooling is confined to the upper 75 percent of column; (4) the column which exhibits the steepest slope for a given operating pressure is the most effective, and when several columns containing the same number of trays are concerned, the most efficient. Proper utilization of these relationships makes it possible to specify accurately, and check, a column's effectiveness without the need of running a precise quality of feed stock, or effecting a precise recovery of a given key component.

E. G. Ragatz, and J. A. Richardson, Bechtel Brothers McCone Co., before 21st annual meeting of the California Natural Gasoline Association, Los Angeles, Oct. 11, 1946.

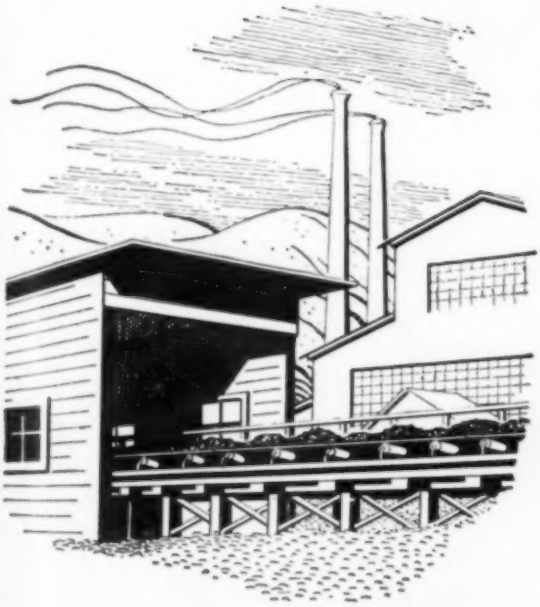
AIR ENTRAINMENT IN CONCRETE

AIR bubbles in concrete may not seem a very desirable method of improving that product, but civil engineers, who have been putting them there purposefully for several years, are obtaining increasingly beneficial results with that practice.

The process is the most popular subject of thought and discussion in the concrete fraternity at the present time, and so much progress has been made in its study and use that the time has arrived for emphasizing the increased requirements for accuracy in the design and control of the mixture used to produce bubbles.

It has been established as a fact, that

When every minute counts!



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When you have to move heavy loads of bulk materials, for example, he will recommend Monarch Conveyor Belting and Robins Conveyors. They're "Job-Engineered" by Hewitt-Robins to do *your* job better.

You see, Hewitt-Robins offers you complete materials handling service . . . backed by a single source and single responsibility for both conveyor machinery and belting.

Before the going gets tough, call your Industrial Supply Specialist. He will recommend the Hewitt conveyor belting best suited to do your job cheaper, faster, and better.

Specify "Hewitt" . . . Phone the Hewitt distributor listed in the classified section of your telephone directory. Or write to Hewitt Rubber of Buffalo, 240 Kensington Avenue, Buffalo 5, New York.

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Division of Hewitt-Robins, Incorporated

"JOB-ENGINEERED" INDUSTRIAL HOSE • BELTING • PACKING

the presence of widely dispersed spheroids of air in concrete will increase the resistance of the hardened mass to frost action and to chemical action by salts used for de-icing pavements far beyond that achieved with non-air-entraining concrete. It is perhaps less widely accepted as factual that purposeful air-entrainment will benefit concrete structures of other than the pavement type. However, air-entrainment used with appreciation of it sensitivity is beneficial in all types of concrete.

The purposefully-created bubbles constitute an additional aggregate in the mixture possessing complete flexibility of shape. The process reduces the "water-of-convenience" in concrete better than any other means yet discovered. The improvement in uniformity of bond offsets completely the possible slight reduction in bond strength, and reinforced concrete is benefitted by use of air-entrainment.

The process generally is described as one in which pine resins, animal or vegetable fats and oils and other saponifiable matter are added to the cement or at the concrete mixer.

Charles E. Wuerpel, U. S. Engineer Department, before American Society of Civil Engineers, Kansas City, Oct. 17, 1946.

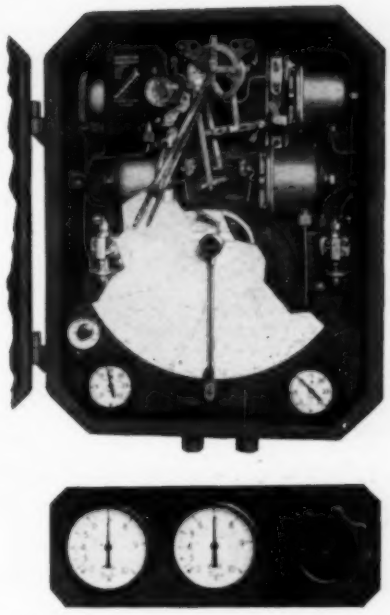
FOREIGN LITERATURE ABSTRACTS

PHENOL-ALDEHYDE RESINS

ALTHOUGH the manufacture of resinous products by condensation of phenols with aldehydes is one of the oldest branches of the synthetic resin industry, it still occupies an important place in this industry. The high mechanical strength, as well as the ready availability, of these resins explains their recent popularity in aircraft and ship construction, as well as other industries. Recent work was carried out in this field to study the rate of reaction of phenol with formaldehyde (in the form of formalin) in the presence of small quantities of alkali catalysts at low temperatures and with very little excess aldehyde. At temperatures not exceeding 50 deg., formaldehyde combines with phenol to form non-viscous solutions containing approximately 35 percent water, 15 percent phenol, and 50 percent of the simpler phenol alcohols, namely saligenin, paraoxybenzyl alcohol and dimethylol phenols, with a predominance of the latter. These solutions mix with water in all proportions, are readily absorbed by fibrous fillers and undergo resinification at 80-100 deg. with the formation of resol resins, so they can be used

More Precise Control... Less Panel Space With

NEW TAYLOR "TRANSET"



"TRANSET" is a new Pneumatic Transmission System particularly adapted to applications involving long lead lines between transmitter and control panel and where compactness of control panel is a consideration for the control of temperature, pressure, rate of flow, and liquid level.

The "Transet" Controller is really a Fulscope Pneumatic-Set Recording Controller-Transmitter. Left hand control mechanism regulates control valve while other side transmits air pressure, proportional to pen movement, to indicating receiver remotely located on panel board.

Left gauge of receiver unit is calibrated in same units of measurement as controller chart and thus provides indication of controlled variable. Right gauge, connected in pneumatic-set line and calibrated in same units as controller chart, indicates set pointer position. Thus, when both pointers of the receiver unit coincide, the pen and set pointer of Transet will be together and process will be at desired control point. Here is what Transet gives you:

1. More Precise Control: Eliminates or greatly reduces time lag in the control circuit because Transet Controller can be at or near the point of measurement.

2. Pneumatic Control at Its Best: The simplicity and dependability of Taylor Fulscope air-operated controllers extended to remote pneumatic transmission.

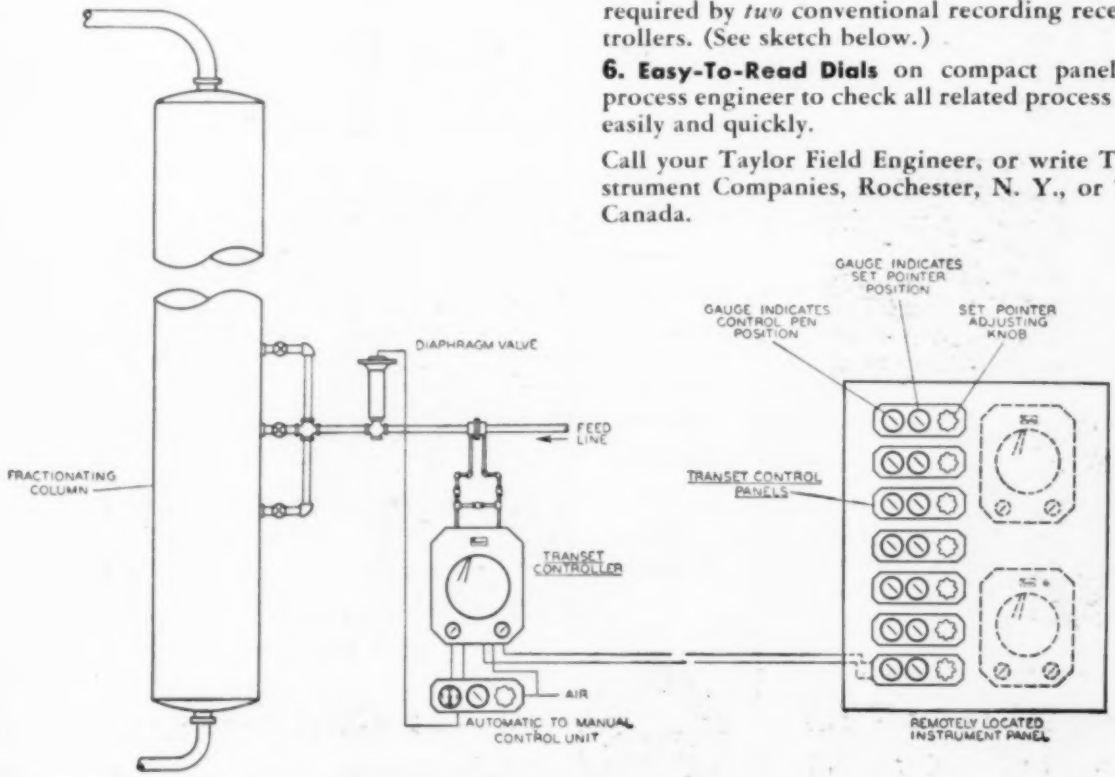
3. Field Tested and Time Proven: No experiment; simply new combinations of standard control features.

4. Standard Case Construction: Contains controller, transmitter and pneumatic-set mechanisms. Also allows space for spring or explosion-proof electric chart drive.

5. Less Expensive Panels and Control Rooms: You can put *seven* Transet receiver units in same space required by *two* conventional recording receiver-controllers. (See sketch below.)

6. Easy-To-Read Dials on compact panels enable process engineer to check all related process variables easily and quickly.

Call your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.



TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

in the manufacture of phenolayers for the preparation of compositions with thermoreactive properties by drying and thermal treatment of their mixtures with fillers. The compositions thus obtained are distinguished by the property of rapidly changing, on heating under pressure, to plastics which are not inferior in their mechanical and other properties to phenolayers obtained from phenol-aldehyde resins. The synthesis of mixtures of phenol alcohols from phenol and formalin makes it possible to considerably simplify the manufacture of many phenolayers and get various types of layered and other plastics without the application of ready made phenol aldehyde resins and organic solvents.

Digest from "Phenol Alcohols as Substitutes for the Thermoreactive Phenol-Aldehyde Resins in the Plastics Industry" by A. A. Vanscheidt and A. A. Vassiliev, *Zhurnal Prikladnoi Khimmi* XIX, No. 1, 7-22, 1946. (Published in Russia.)

POLYVINYL BUTYL ETHER

A SIMPLE and practical method developed recently by Favorsky and Shostakovsky for the preparation of vinyl ethers by the action of acetylene on alcohol in the presence of alkali, has made these ethers available for the synthesis of polymers. A study was therefore made on the polymerization of *n*-butyl vinyl ether with the following different catalysts: I_2, $SnCl_2$, $SnCl_4$, $AlCl_3$, $FeCl_3$, and BF_3, both in the presence and in the absence of sulphur dioxide. Polymerization was carried out in the temperature range of 55 to 60 deg. The polymers of *n*-butyl vinyl alcohol are very viscous and sticky, poorly flowing liquids, soluble in ether and benzene, insoluble in alcohol and water, and of low molecular weight, approximately 5,000. Oxidation of the polymer yields butyric and oxalic acids, showing that the polymer is a derivative of 1,3-glycol. The butyl groups can be hydrolyzed and yield polyvinyl alcohol, and they can be substituted in part by acetyl groups with the formation of mixed ether-ester.

Digest from "Polyvinyl Derivatives. II Polyvinyl Butyl Ether" by V. V. Korshak and V. A. Zamyatin, *Zhurnal Obshchei Khimii* XV, No. 11-12, 947-951, 1945. (Published in Russia.)

DECOLORATION OF SUGAR SIRUPS

CERTAIN anions have a detrimental effect on the decoloration of sirups with bone black. To determine this effect, experiments were carried out with 300 g. of crystal sugar dissolved in 170 ml. of water. 10 ml. of a normal solution of the anion (such as chloride, acetate, lactate, succinate, etc.) and 10 g. of pulverized bone black were added to this solution. The mixture was maintained at 90 deg. for 15 min. and filtered. The pH was adjusted to

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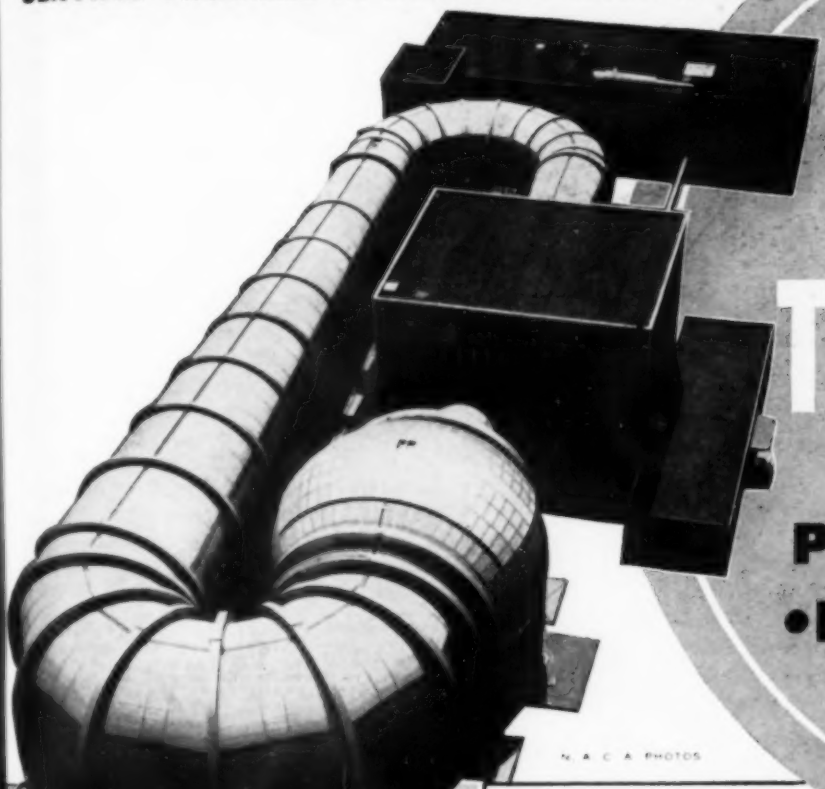

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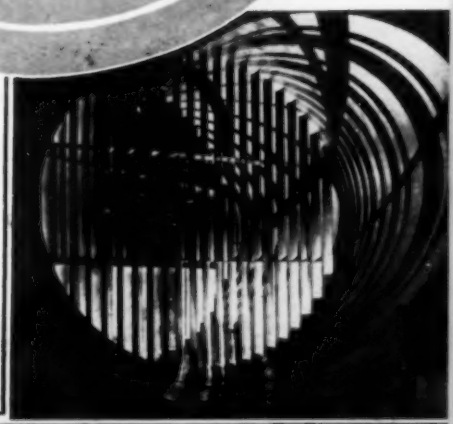

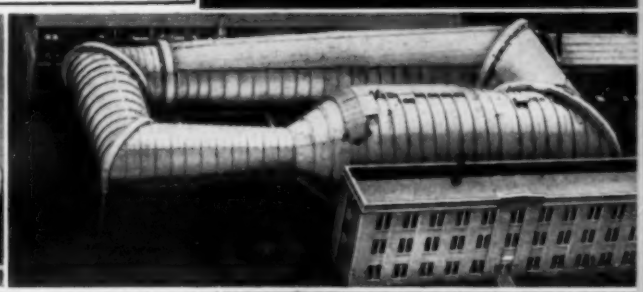

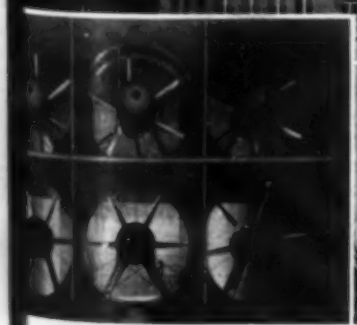

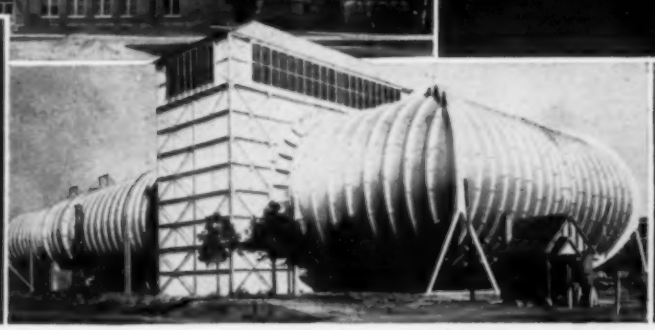

* A few of the very many Wind Tunnels, including the world's largest, built by P.DM for our government and private industry.

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7.0 and the readings made with a photoelectric colorimeter. These experiments showed that the anions adsorbed as a result of physical affinities, or by secondary chemical reactions, have considerable influence on the power of adsorption of charcoals for coloring matter in sirups which are of an electro-negative nature. A series of tests was also conducted to determine the degree of this influence by varying the quantity of anion (phosphate). It was found that even small quantities of the anion cause a considerable decrease in the decoloring power of the charcoal. The detrimental effect appears to exist only in the case of the anion attached to a monovalent cation. When the cation is polyvalent, the detrimental effect of the anion is compensated by the favorable effect of the cation. The intensity of the detrimental effect of anions therefore depends on the valence as well as the solubility of their calcium salt.

Digest from "Influence of Anions on the Decoloration of Sugar Sirups by Means of Bone Black" by Kurt Löwy, *Anais da Associacao Química do Brasil* V, No. 1 17-20, 1946. (Published in Brazil.)

FIRST CHILE CONVENTION OF ENGINEERING STUDENTS

THE CONVENTION held last July 9-14th coincided with the celebration of the 26th anniversary of the School of Chemical Engineering of the University of Concepcion, which organized the convention. Members of the School of Engineering of the University of Chile, the Catholic University of Chile and the State School of Engineering also participated. University faculty members and local industry and commerce offered their help in organizing the convention. Guillermo Weber was president, Sergio Droguett was secretary, and Jorge Rodriguez was treasurer of the Organization Committee. The first committee was in charge of papers on pure and applied sciences, including mathematics, physics, chemistry, industrial chemistry, metallurgy, electrical engineering, construction engineering and road engineering. The second committee presented papers on engineering in the industrialization of Chile. These covered engineering and industrial activities in the north zone (saltpeter, copper, manganese and sulphur), the central and south zones; engineering in future industries, including: plan for industrialization of Chile, heavy industry and siderurgy, fuels (coal, petroleum and schists) and chemical industries; and promotion of production. The third committee covered such general themes as engineering vs. technique, etc.

Digest from "First Convention of the Engineering Students of Chile" *Revista de Ingenieria Química*, Universidad de Concepcion, V, No. 4-5, 107-123, 1945-46. (Published in Chile.)

CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

GETTING THE OIL

PETROLEUM PRODUCTION ENGINEERING, OIL FIELDS DEVELOPMENT. *Third Edition. By Lester C. Uren. McGraw-Hill Book Co., New York. 764 pages. $7.*

Reviewed by D. F. Othmer

THIS book was first written "to provide a text or work of primary reference for petroleum engineering students in that part of their curriculum which pertains to the technology of oil field development and petroleum production." It has filled that purpose well during the previous two editions; and the present one rounds out the coverage of the field by describing the notable advances in techniques which have made possible the much greater depths now possible in wells, new and more efficient types of drilling equipment, new methods of installing and cementing casing in wells, new methods of logging, testing and completing wells, and the better definition of principles governing oil field development practice. The approach has been from the engineering standpoint, which has been increasingly important in this phase of the oil industry.

SOUTHERN NEIGHBORS

INDUSTRIALIZATION OF LATIN AMERICA. *Edited by Lloyd Hughlett. McGraw-Hill Book Co., New York. 493 pages. $5.*

THE RECENT war served the useful purpose of drawing the Americas much closer together. For the first time many of us in the United States became acquainted with our neighbors to the south. We called on them for rubber, bauxite, vegetable oils, and many other products. They in turn depended on us for many of their requirements. Latin America made a splendid record in supporting the war effort and has built credits, much greater than at any time in her history, for postwar use. This closer association makes a better understanding of conditions in the Latin American countries on the part of chemical management a must.

The editor of this volume has wisely chosen to add to his own first-hand knowledge of conditions that of 25 to 30 business-men contributors. Drawing upon their many years of experience in promoting, developing and fashioning the course of industrial expansion in Latin America, they are in an exceptional position to describe their respective fields. The symposium offers a valuable contribution to chemical management interested in developing trade with our southern neighbors. The studies cover at length the present development and future possibilities of the industry that can be supported by Latin American natural resources, labor and capital. Several of the chapters deal with individual chemical process industries, heavy chemicals, cement, food, leather, paint and varnish, petroleum refining, pharmaceutical, pulp and paper, and sugar refining. Several others are of equal importance, power, textiles, transportation and mining.

PSYCHOLOGY

PERSONAL ADJUSTMENT. *By Knight Dunlap. McGraw-Hill Book Co., New York. 433 pages. $4.*

Reviewed by H. H. Bliss

THIS book contains a collection of psychological facts of life drawn from the author's 40 years of teaching and counseling experience. He interprets persons and people who tend to react in unexpected and disadvantageous manners. He incorporates material around such topics as learning processes, mental disorders, features of neurotic maladjustments, readjustments, sex and marital adjustments, and various types of maladjusted persons. This book broadens the basis for comprehending vagaries of human behaviour; it does not implement the engineer with special techniques for handling ticklish situations. The executive-minded engineer will benefit from reading to the extent that he recognizes the inadequacies of his own understanding and his need for improving the personnel relationships centering around him. Although he will miss his favorite concentration of demonstrable facts woven into a pattern of know-how, the engineer will find relief in following a psychologist's point of view divorced completely from psychoanalytical entanglements.

CORRAL

MODERN ORGANIC FINISHES. *By Rollin H. Wampler. Chemical Publishing Co., Brooklyn. 452 pages. $8.50.*

Reviewed by Myron A. Coler

DURING recent years the transition of surface technology from an empiric art to an engineering science has taken place with encouraging acceleration. However, much of the pertinent information is still widely scattered in articles, trade notes, manufacturers' literature, specifications and miscellaneous files. This is particularly true in the field of organic finishes (primarily coatings of which the binder or filmogen is an organic compound—more familiarly known by such terms as paints, varnishes and lacquers). A book, like the present one, which tries to corral the diffusely scattered information performs a useful service.

The volume is divided somewhat unevenly into six nominal sections. The first seeks to characterize the principal finishing materials. The materials are classified partially by composition and partially by end use. Sections II, III and IV deal respectively with application methods, drying and curing methods and product handling. The fifth section discusses finishing systems along three lines: the substrate to be finished, the field of use of the product, and auxiliary processes involved in finishing systems. Section VI is comprised of a chapter on good practice in the finishing department and a somewhat sketchy chapter on evaluation and test methods. The con-

RECENT BOOKS RECEIVED

Drying Oils, Thinners and Varnishes. By J. S. Remington. Leonard Hall, London. 12s, 6d.

Inorganic Syntheses, Vol. II. Ed. by W. C. Fernelius. McGraw-Hill. $4.

Organic Syntheses. Ed. by Homer Adkins. Wiley. $2.

Pigments, Their Manufacture and Properties. By J. S. Remington. Leonard Hall, London. 12s.

Qualitative Analysis by Spot Tests. 3rd ed. By Fritz Feigl. Elsevier. $8.

Rarer Metals. By J. De Ment & H. C. Dake. Chemical. $7.50.

Talbot's Quantitative Analysis. 9th ed. By L. F. Hamilton & S. G. Simpson. Macmillan. $4.

cluding bibliography provides a number of important and helpful references.

Although the organizational pattern entails points of overlap, the book is weakened by the attempted breadth. It is not possible to cover evenly and adequately a descriptive subject ranging from recipes for the bright dipping of copper and its alloys to the testing and evaluating of organic finishes in a single volume of the present size. There are several statements which involve unorthodox terminology or require cautious interpretation, e.g., p. 18—"The finish on a modern automobile will last as long as the car itself . . ."; p. 290—"The key to preventing corrosion is to stop the flow of the local electrical currents, called eddy currents . . ."; p. 334—"There are a thousand different shades of white . . .". The text is supplemented by a substantial number of pertinent photographs and drawings. Unfortunately, the choice of type is such that the captions on the figures may be confused with the body of the text in a few instances.

The book will be of particular interest to those concerned with the application and cure of organic finishes in general and those concerned more specifically with the finishing of wood products. The treatment of application methods is enhanced by the inclusion of information on the less frequently discussed techniques and auxiliaries such as centrifugal finishing, mechanical graining and the use of decals, masking pastes and striping tools, etc. Emphasis is placed on industrial and production line finishing rather than on structural, architectural and maintenance work. The producer of organic coating materials will find little information that he can employ directly in the formulation and manufacture of finishes; however, not only manufacturers but also experienced users will find many valuable suggestions on the practical application of organic finishes and the efficient routing of items through the coordinated steps of diverse finishing systems.

SYMPOSIUM

WHAT INDUSTRY OWES TO CHEMICAL SCIENCE. *A symposium by 53 contributors. Chemical Publishing Co., Brooklyn. 372 pages. $5.*

ISSUED by authority of the Council of the Royal Institute of Chemistry, London, this book had its origin in a series of articles contributed to *The Engineer*, London, during the first World War. The authors of the present work are associates or fellows of the Royal Institute, and are expert in the subjects they cover. Deliberately written

in non-technical language, the articles will be of more value to the layman than to the technologist, although students of chemistry will get an insight into the wide and varied applications of chemistry in industry. Obviously only a brief outline of each application can be given in so small a scope. Following an introduction by Alexander Findlay, president of the Royal Institute of Chemistry, 18 chapters deal with as many kinds of industry in which chemistry and the chemist play an important part.

RECENT BOOKS and PAMPHLETS

Ceramic Whitewares. By Rexford Newcomb, Jr. Published by Pitman Publishing Corp., 2 West 45th St., New York, N. Y. 313 pages. $5. History, technology, applications—current data for both users and makers of ceramics.

Chemical Age Year Book, 1947. Published by Benn Brothers, Ltd., Fleet Street, London, E. C. 2. 25th year of this British publication.

A.S.T.M. Standards on Paper and Paper Products. Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 232 pages. $2. Third edition provides 57 specifications, test methods and related standards.

Engineering and Human Affairs. Published by Princeton University, Princeton, N. J. 32 pages. A summary of the Princeton Bicentennial Conference on "Engineering and Human Affairs" held last October.

Electrolytic Conductivity Curves. Published by Industrial Instruments, 17 Pollack Ave., Jersey City 5, N. J. $1.50 per set. Charts of data giving concentration vs. specific conductance at various temperatures. Four sets are available: NaCl, NaOH, HCl, and $CaCl_2$. More sets will be available.

Aniline. Published by Division of Labor Standards, U. S. Department of Labor, Washington 25, D. C. 14 pages. Series No. 5 of "Controlling Chemical Hazards." Safety precautions for the industrial use of aniline.

Starch for Paper Coating. Tappi Monograph Series No. 3, edited by R. T. Bingham. Published by Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York, N. Y. 120 pages. Chemistry, application, production and other factors in the use of starches by the paper industry.

Machine Design. Fifth edition. By L. J. Bradford and P. B. Eaton. Published by John Wiley & Sons, 440 Fourth Ave., New York, N. Y. 283 pages. $3.25. Textbook.

Industrial Peace and the Wagner Act. By T. R. Iserman. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. 91 pages. $1.50. How the Act works and what to do about it.

Sugar and Sugar By-Products in the Plastics Industry. By L. Long, Jr. Published by Sugar Research Foundation, 52 Wall St., New York 5, N. Y. 61 pages. A survey of the patent and periodical literature made in view of the potential importance of plastics to the sugar industry.

The Utilization of Sugar Cane Bagasse for Paper, Board, Plastics and Chemicals. Edited by C. J. West. Published by Sugar Research Foundation, 52 Wall St., New York 5, N. Y. 146 pages. An annotated bibliography.

Invertase. By C. Neuberg and I. S. Roberts. Published by Sugar Research Foundation, 52 Wall St., New York 5, N. Y. 62 pages. A monograph about the biocatalyst (enzyme) which hydrolyzes sucrose into glucose and fructose.

Symposium on Materials for Gas Turbines. Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 199 pages. $3. Eight papers reporting research on metals and alloys for this high temperature application.

Specifications and Tests for Electrodeposited Metallic Coatings. Published by American So-

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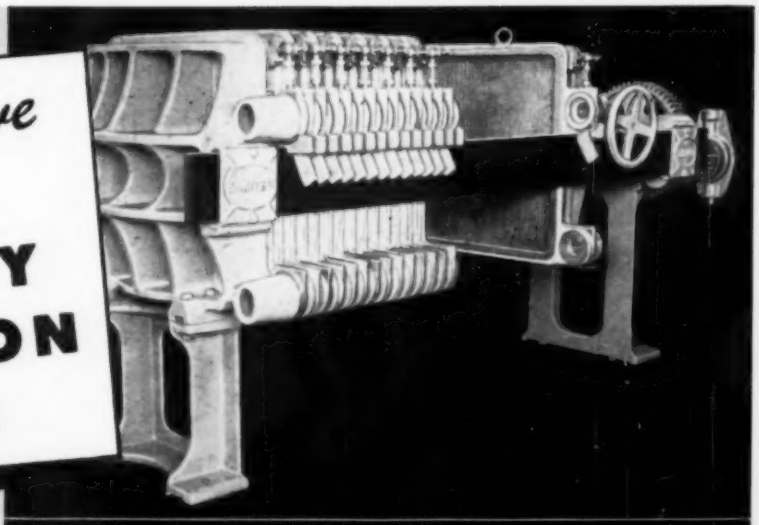

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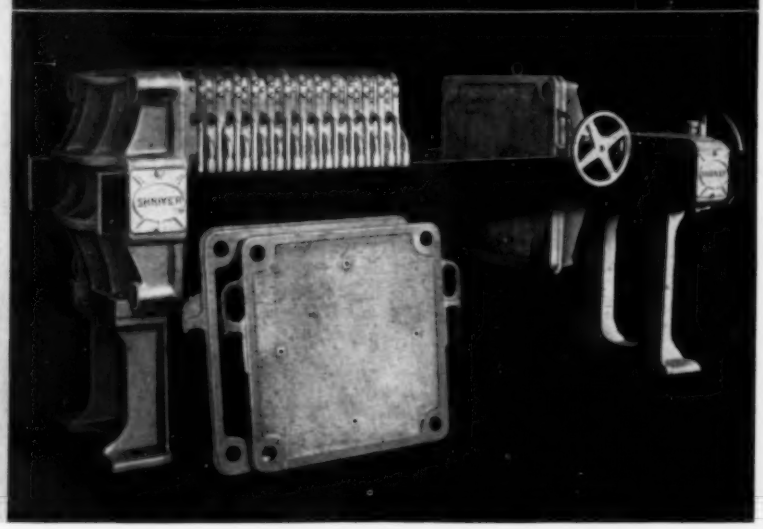

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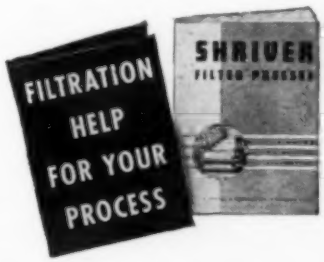

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ciety for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 46 pages. $1.25. Eleven specifications, methods of testing and recommended practices sponsored jointly by ASTM and the American Electroplaters' Society.

British Chemicals and Their Manufacturers, 1946. Published by the Association of British Chemical Manufacturers, 166 Piccadilly, London, W.1. 121 pages. A classified list of chemical products giving the British manufacturer of each.

Reynolds Aluminum Alloys and Mill Products. Published by Reynolds Metals Co., Louisville 1, Ky. 245 pages. $2. Technical information on aluminum alloys featuring 106 tables of technical data.

Pentaerythritol Uses—A Bibliography. Prepared by Burrell and Neidig, Inc., 115 Broadway, New York 6, N. Y. 440 pages. $15. 354 annotated references to patents and articles.

Silicones: Food for Imagination. By R. R. McGregor. Available from Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh 13, Pa. 10 pages. Gratis. An address reprinted from the "Journal of the Franklin Institute."

Paraformaldehyde. Manual Sheet SD-6, published by Manufacturing Chemists' Association, 608 Woodward Bldg., Washington 5, D. C. 4 pages. 15 cents. Essential information for the safe handling and use of paraformaldehyde. Sixth in the MCA series of chemical plant safety manuals.

Production Comes From People. Published by Industrial Hygiene Foundation, 4400 Fifth Ave., Pittsburgh 13, Pa. 12 pages. Gratis. A description of the activities of the Foundation.

Five Years of Synthetic Rubber. Published by United States Rubber Co., Rockefeller Center, New York 20, N. Y. 50 pages. Gratis. Shows dramatic growth of the industry with authoritative appraisal of its importance today. Types of synthetic rubber are identified and described in detail.

Laboratory Manual in Metallography. By J. F. Eckel and R. J. Raudebaugh. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. 344 pages. $4.50. Loose-leaf manual with 42 experiments.

Co-ordination of Motive, Men and Money in Industrial Research. Prepared by Darrell H. Voorhies. Published by Standard Oil Co. of Calif., 225 Bush St., San Francisco. 64 pages. Scope, types and motives of industrial research; general organization and coordination; management guides for executives and key staff personnel; and the provision of funds and their control. Included are extensive charts illustrating divisions of responsibility, executive functions, relationships and limits of authority.

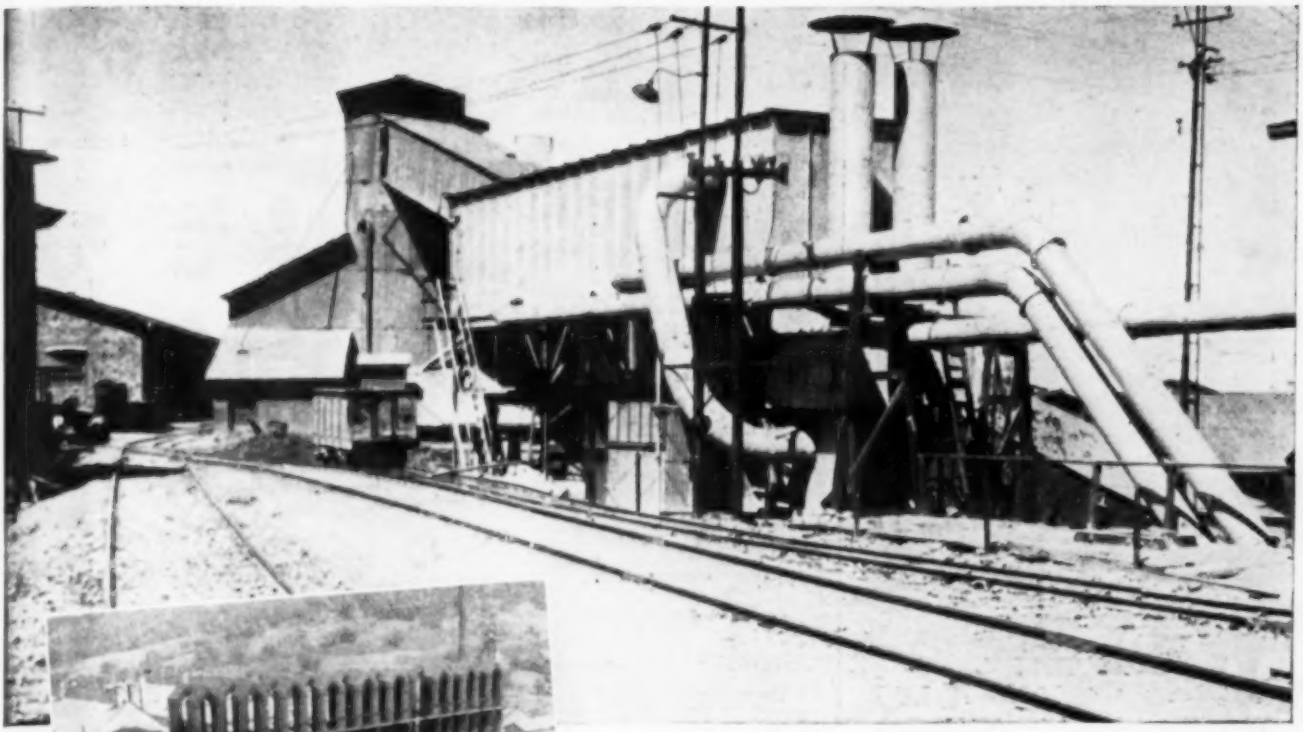
Tenth Annual Wine Industry Statistical Survey, Part III. Published by the Wine Advisory Board of the Wine Institute, 717 Market St., San Francisco 3, Calif. 17 pages. Completes a series of three statistical bulletins on crush, production, consumption, inventories and other wine industry activities in the United States during the 1945-46 crop period.

California Oil Fields. Published by California Department of Natural Resources, Division of Oil and Gas, Ferry Bldg., San Francisco 11, Calif. 159 pages. Thirty-first annual report. Contains a descriptive survey of the Coalinga oil field, a resume of statewide oil operations in 1945, production statistics, wildcat wells and a directory of California oil operators. Several maps of the Coalinga field are included.

Revised List of Publications. Published by California Department of Natural Resources, Division of Mines, Ferry Bldg., San Francisco 11, Calif. 33 pages. A list of publications dealing with mining activities and methods, minerals and mineral deposits, processing, maps and department investigations.

Commercial Fertilizers and Agricultural Minerals, 1945. Published by Bureau of Chemistry, California State Department of Agriculture, 241 Mull Bldg., 1125 10th St., Sacramento 14, Calif. 95 pages. Extensive charts showing the tonnage and analysis of all commercial fertilizers and agricultural minerals sold in California during 1945.

Economic Base for Power Markets in Skagit County, Washington. By Carol Colver. Published by Bonneville Power Administration, Portland 8, Ore. 79 pages. Appraises the prospects for electric power consumption in this area. Reviews the physical base, people and their incomes, production, employment and public facilities and finance. A map, photographs, charts showing inter-industrial relations and appendix tables covering employment, power costs, incomes, crop and industrial production and taxes are included.



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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

Foreign Commerce and Navigation of the United States for the Calendar Year 1943. Vol. 1, Import and Export Statistics, Section A. Price $4. Vol. 1, Import and Export Statistics, Supplement. Price $1.75. Vol. 2, Export Transport Statistics. Price $2. Bureau of the Census. Cloth.

Statistical Abstract of the United States, 1946. Bureau of the Census. Price $2.25. Cloth.

Painting Interior Walls and Trim. By E. F. Hickson and P. T. Howard. National Bureau of Standards, Letter Circular LC-837. Very elementary, but lists some other more technical material. Mimeographed.

Lime: Technical Publications by Members of the Staff of the National Bureau of Standards. National Bureau of Standards, Letter Circular LC-835. Mimeographed.

A Photoelectric Refractometer. By Enoch Karrer and Rollin S. Orr. Bureau of Agricultural and Industrial Chemistry, AIC-126. Mimeographed.

The Economic Report of the President, Transmitted to Congress January 8, 1947. House Document No. 49. Price 15 cents.

Government-Owned Pipe Lines. Report of the War Assets Administration to Congress December 18, 1946. Price 10 cents.

Report of the Secretary of the Interior on the Synthetic Liquid Fuels Act from January 1, 1946 to December 31, 1946. Available free from Office of Synthetic Liquid Fuels, Bureau of Mines, Washington 25, D. C. Mimeographed.

List of Publications of the U. S. Department of Agriculture from January 1941 to December 1945, Inclusive. Department of Agriculture, Miscellaneous Publication No. 611. Available free from U. S. Department of Agriculture, Washington 25, D. C.

Washing Characteristics of the Pittsburgh Coal in a High-Sulfur Area in Greene County, Pa. By Thomas Fraser and William L. Crentz. Bureau of Mines, Technical Paper 689. Price 15 cents.

Carbonizing Properties of Velva Lignite from Ward County, N. Dak., and Monarch Coal from Sheridan County, Wyo. By D. A. Reynolds, et al. Bureau of Mines, Technical Paper 692. Price 10 cents.

Exploration of the Crowell Fluorspar Mine, Nye County, Nevada. By Robert W. Geehan. Bureau of Mines, Report of Investigations R. I. 3954. Mimeographed.

Metallic Titanium and Its Alloys. By R. S. Dean and B. Silkes. Bureau of Mines, Information Circular I. C. 7381. Mimeographed.

Exploration of Barite Deposits in Montgomery County, Ark. By Robert B. McElwaine. Bureau of Mines, Report of Investigations R. I. 3971. Mimeographed.

Exploration of Alunite Deposits, Marysvale, Piute County, Utah. By John H. Hild. Bureau of Mines, Report of Investigations R. I. 3972. Mimeographed.

Coal Preparation Practice in Western Germany. By Thomas Fraser and M. G. Driessen. Bureau of Mines, Information Circular I. C. 7389. Mimeographed.

Exploration of the Cherokee Iron Deposits, Cherokee County, North Carolina. By Almon

F. Robertson. Bureau of Mines, Report of Investigations R. I. 3974. Mimeographed.

Exploration of Iron Mountain Titaniferous Magnetite Deposits, Albany County, Wyo. By Eugene Frey. Bureau of Mines, Report of Investigations R. I. 3968. Mimeographed.

A Method for the Spectrochemical Determination of Germanium, Tin, and Lead in Ore Samples. By Graham W. Marks and H. Tracy Hall. Bureau of Mines, Report of Investigations R. I. 3965. Mimeographed.

Exploration of a Nickel-Copper-Cobalt Deposit at Funter Bay, Admiralty Island, Alaska. By Stephen P. Holt and Joel M. Moss. Bureau of Mines, Report of Investigations R. I. 3950. Mimeographed.

Exploration of Coal Deposits of the Point Barrow and Wainwright Areas, Northern Alaska. By Robert S. Sanford and Harold C. Pierce. Bureau of Mines, Report of Investigations R. I. 3934. Mimeographed.

Exploration of the Jumbo Basin Iron Deposit, Prince of Wales Island, Southeastern Alaska. By W. S. Wright and E. L. Fosse. Bureau of Mines, Report of Investigations R. I. 3952. Mimeographed.

Exploration of the Brown-Iron Ores, Churchwell and Robinette Tracts, Western Highland Rim District, Wayne County, Tennessee. By A. H. Warner and G. A. Morrison. Bureau of Mines, Report of Investigation R. I. 3955. Mimeographed.

Exploration of Argentiferous Lead-Copper Deposits of the Slana District, Alaska. By Robert L. Thorne. Bureau of Mines, Report of Investigations R. I. 3940. Mimeographed.

Exploration of the Queen Mary Copper Project, Missoula County, Mont. By Wilder H. Brinton. Bureau of Mines, Report of Investigations R. I. 3973. Mimeographed.

Exploration of the Reward (Vekol) Zinc Deposit, Pinal County, Arizona. By Thomas C. Denton and P. S. Haury. Bureau of Mines, Report of Investigation R. I. 3975. Mimeographed.

Exploration of O'Jack Mining Co. Zinc and Lead Deposits, Jasper County, Missouri. By Louis C. Brichta. Bureau of Mines, Report of Investigations R. I. 3970. Mimeographed.

Summarized Statistics of Production of Lead and Zinc in the Tri-State (Missouri-Kansas-Oklahoma) Mining District. By A. J. Martin. Bureau of Mines, Information Circular I. C. 7383. Mimeographed.

List of Reports and Publications on the Use of Wood in Aircraft Construction. Forest Products Laboratory, Madison, Wis. No. R54. Mimeographed.

Curing of Resorcinol-Resin Glues at Temperatures from 40° to 80° F. By W. Z. Olson, et al. Forest Products Laboratory, Madison, Wis. No. R1629. Mimeographed.

Treatment of Wood with Urea Resin-Forming Systems. Part 1—Dimension Stability. By M. A. Millett and A. J. Stamm. Forest Products Laboratory, Madison, Wis. No. R1632. Mimeographed.

The Elastic Properties of Wood. Various pamphlets recently issued by Forest Products Laboratory, Madison, Wis., are: Young's Moduli, Moduli of Rigidity, and Poisson's Ratios of Mahogany and Khaya. By D. V. Doyle and J. T. Drow. No. 1528-C. Young's Moduli and Poisson's Ratios of Douglas-Fir and Their Relations to Moisture Content. By R. S. McBurney and J. T. Drow. No. 1528-D. The Moduli of Rigidity of Douglas-Fir at About 11 Percent Moisture Content. By D. V. Doyle, et al. No. 1528-E. Young's Moduli, Poisson's Ratios, and Moduli of Rigidity of Sweetgum at Approximately 11 Percent Moisture Content. By R. S. McBurney, et al. No. 1528-F. Young's Moduli, Moduli of Rigidity, and Poisson's Ratios of Yellow Birch. By J. T. Drow and R. S. McBurney. No. 1528-H. Mimeographed.

Bolt-Bearing Strength of Wood and Modified Wood. By A. M. McLeod. Forest Products Laboratory, Madison, Wis. No. 1523-C. Mimeographed.

A Single Stiffener Perpendicular to Stress Face Grain of Plywood at 45° to Its Edges. Supplement to Buckling of Stiffened, Flat, Plywood Plates in Compression. By T. B. Herbink and C. B. Norris. Forest Products Laboratory, Madison, Wis. No. 1553-A. Mimeographed.

The Budget of the U. S. Government. Budget Message and Summary, $1. Complete Budget, $5.

MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Readers' Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without cost or obligation (unless a price is specifically mentioned). Please check the items you wish to receive and fill out the coupon. Please send requests to Readers' Service, Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

1

Adhesives. Paisley Products, Inc., Chicago, Ill.—Bulletin No. 15 is a two-page flyer featuring the Cooler-Proof Glue for labeling bottles subject to wet storage. Description and properties of the glue are given, and various applications are described.

2

Blenders. Sprout, Waldron & Co., Muncie, Pa.—8-page booklet featuring this company's equipment for blending insecticides. The importance of proper blending of insecticides is discussed in some detail, and the equipment for accomplishing this blending is described and illustrated.

3

Building Materials. A. C. Horn Co., Inc., Long Island City, N. Y.—96-page handbook of construction data contains technical information on products made by this company, such as flooring materials, coatings, roofing materials, waterproofing, etc. A section is devoted to useful engineering tables, conversion factors, estimating tables, weights and strength of building materials, etc.

4

Chemicals. Armour & Co., Chicago, Ill.—4-page leaflet entitled "Armeen Salts" discusses the aliphatic amine salts and their use as penetration assistants and water repellants. Contains information on the characteristics of these compounds such as properties, composition, and other useful information.

5

Chemicals. Armour & Co., Chicago, Ill.—Four 1-page charts giving the physical properties, molecular weight, refractive index, density, flash point, boiling point, solubilities of n-aliphatic acids, amines, amides and nitriles.

6

Chemicals. Chemical Solvents, Inc., Newark, N. J.—64-page plastic bound booklet entitled "Solvents, Alcohols, Extenders." Contains specifications, properties and outstanding characteristics of the chemicals available from this company. Contains formulas and information on denatured alcohol, and includes excerpts from Internal Revenue regulations on denatured alcohol.

7

Chemicals. Godfry L. Cabot, Inc., Boston, Mass.—An 11 x 14-in. colored plastic chart showing the application of this company's carbon black in various industrial products. Shows the type of carbon black for use in such applications as ink, rubber, enamels, plastics, etc.

8

Chemicals. Griffin Chemical Co., San Francisco, Calif.—Booklet entitled "Light Hydrocarbon Properties." Presents in tabular form, hydrocarbon and light petroleum liquid and gas properties, with thermal data and data on combustion.

9

Chemicals. Oronite Chemical Co., San Francisco, Calif.—4-page folder giving the properties and applications of Oronite synthetic detergent, a compounding material for industrial washing and cleaning operations.

10

Chimney Construction. The Weber Chimney Co., Chicago, Ill.—6-page folder showing the effect of the atomic bomb on chimneys built by this company.

11

Chlorinated Rubber. Hercules Powder Co., Wilmington, Del.—32-page booklet giving the properties and uses of Parlon, this company's chlorinated rubber. Contains detailed information on the chemistry of this type of compound, as well as its physical properties. Includes information on the application in alkyd enamels, paints, varnishes, and various types of finishes, as well as inks, adhesives and coatings.

12

Crushers. American Pulverizer Co., St. Louis, Mo.—8-page booklet featuring the stone crushers made by this company. Advantages, ratings, dimensions for this company's line of hammer and rolling ring stone crushing mills are included.

13

Crushers. The Jeffrey Mfg. Co., Columbus,

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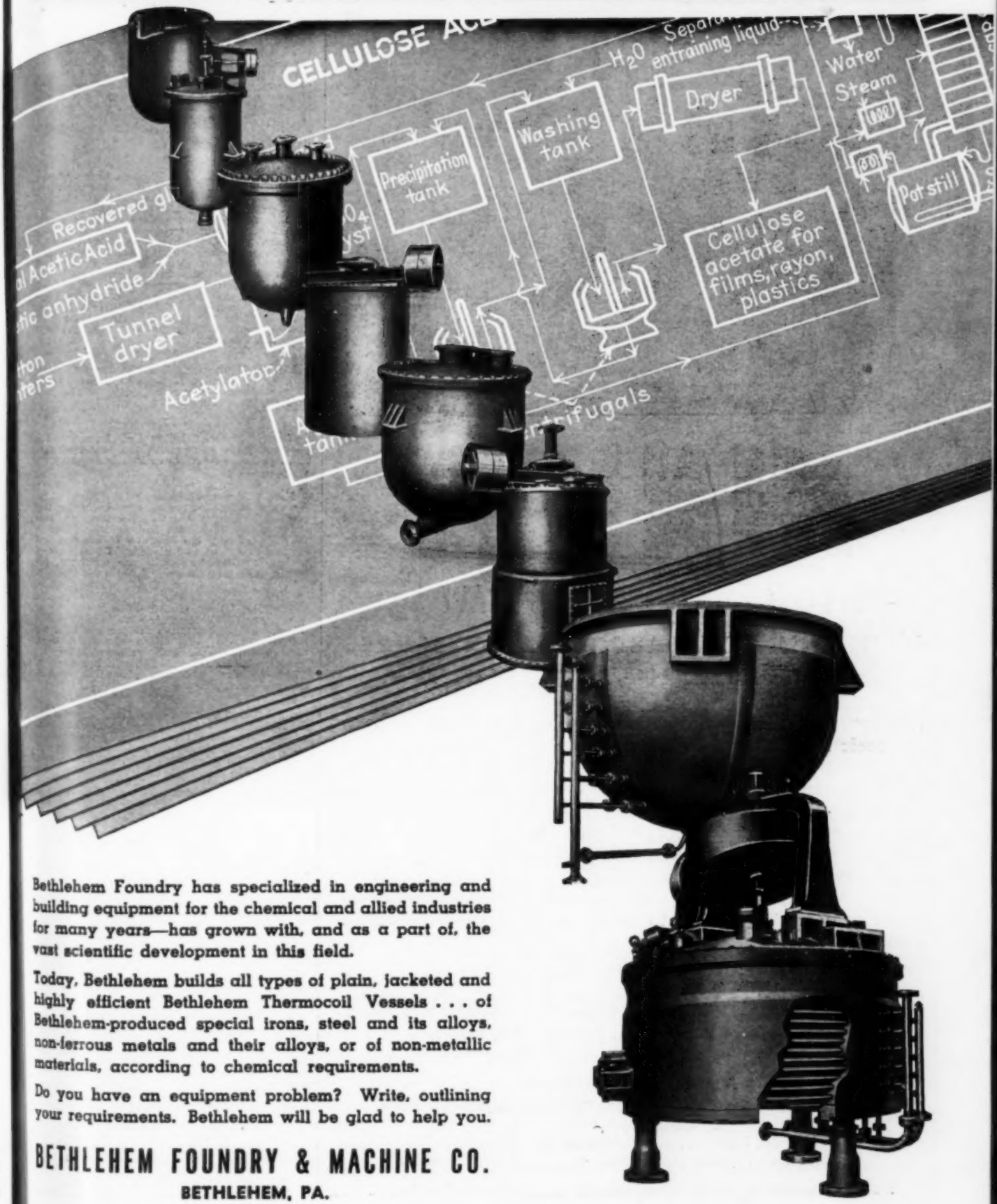

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Ohio—Bulletin No. 794. 8-page illustrated booklet featuring the double-roll crushers manufactured by this company. Contains information on various types of applications. The equipment itself is illustrated by cutaway views and drawings. Contains tables of speeds, shipping weights, dimensions, etc.

14

Dust Collectors. Peters-Dalton, Inc., Detroit, Mich.—Bulletin 101, entitled "Hydro Whirl Dust Collector," illustrates and describes the industrial dust collecting equipment made by this company. Principles of operation are described and illustrated with sketches and the various types of equipment are depicted both in photographs and drawings. Method of planning and laying out a dust collecting system is described and illustrated. Contains a table of air velocities for conveying various type osf dust material. Bulletin 201 features this company's wet type spray booth.

15

Dust Collectors. The Thermix Corp., Greenwich, Conn.—Catalog 101 is a 12-page illustrated booklet featuring the Aerotec industrial dust collectors available from this company. Details of design and performance are given, and diagrammatic sketches illustrate the construction details. Dimensions and capacities of the various sizes are tabulated. Catalog 200 contains 20 pages featuring the Prat-Daniel stacks and dust collectors in the process industries. Various types of equipment, such as fans, cyclones, stacks and dust collectors are illustrated and described. Catalog 10 is a 12-page bulletin giving the features and advantages of Heacon dampers for controlling flow, available from this company.

16

Electric Equipment. Rex Rheostat Co., Baldwin, N. Y. Catalog 3. 8-page illustrated booklet describing the various types of rheostats made by this company.

17

Electric Motors. Elliott Co., Jeannette, Pa.—4-page leaflet announcing the new steel fabricated motor manufactured by this company.

18

Fans. Sprout, Waldron & Co., Muncie, Pa.—4-page leaflet illustrating and describing this company's industrial fans. Features of construction are illustrated and described, and a table designating the direction of rotation and discharge of fans is included. Dimensions of the various types of units are tabulated, capacity tables are shown. Bulletin F, 946.

19

Filters. Oliver United Filters, Inc., New York, N. Y.—Bulletin 123-R. 4-page leaflet describing and illustrating the pressure filter for filtering or polishing liquid chemicals, dyes, fruit juices, syrups, and similar materials requiring clarification. Includes information on filter elements, operation, precoating, capacities and sizes.

20

Filters. Proportioneers, Inc., Providence, R. I. Bulletin 1550. 12-page booklet illustrating and describing the Pur-o-cel pressure filter which uses diatomaceous earth for filtering and polishing water, solvents, cutting oils, wines, food oils, etc. The principle of operation is discussed in some detail and the equipment is illustrated with photographs and diagrammatic sketches.

21

Fire Protection. Randolph Laboratories, Inc., Chicago, Ill.—Slide rule type, fire extinguisher data guide, which gives important facts about the suitability, maintenance and performance of various types of fire extinguishers.

22

Fractionating Distillation Equipment. Glas Engineering Laboratories, San Carlos, Calif.—6-page illustrated booklet describing the Oldershaw perforated plate fractionating column for laboratory use. Includes physical and operating data on the 26-mm. plate columns, automatic liquid dividing still head and automatic vapor dividing still head.

23

Heat Enclosures. Geo. P. Reintjes Co., Kansas City, Mo.—Catalog C-46. 34-page booklet featuring the furnace wall construction available from this company. Various types of construction are illustrated and described and a number of examples of this company's work are featured.

24

Heat Treating. Ajax Electric Co., Inc., Philadelphia, Pa.—Reprint entitled "Liquid Carburizing" discusses all phases of liquid carburizing, both technical and the economic as compared with other types of carburizing.

25

Heat Treating. Surface Combustion Corp.

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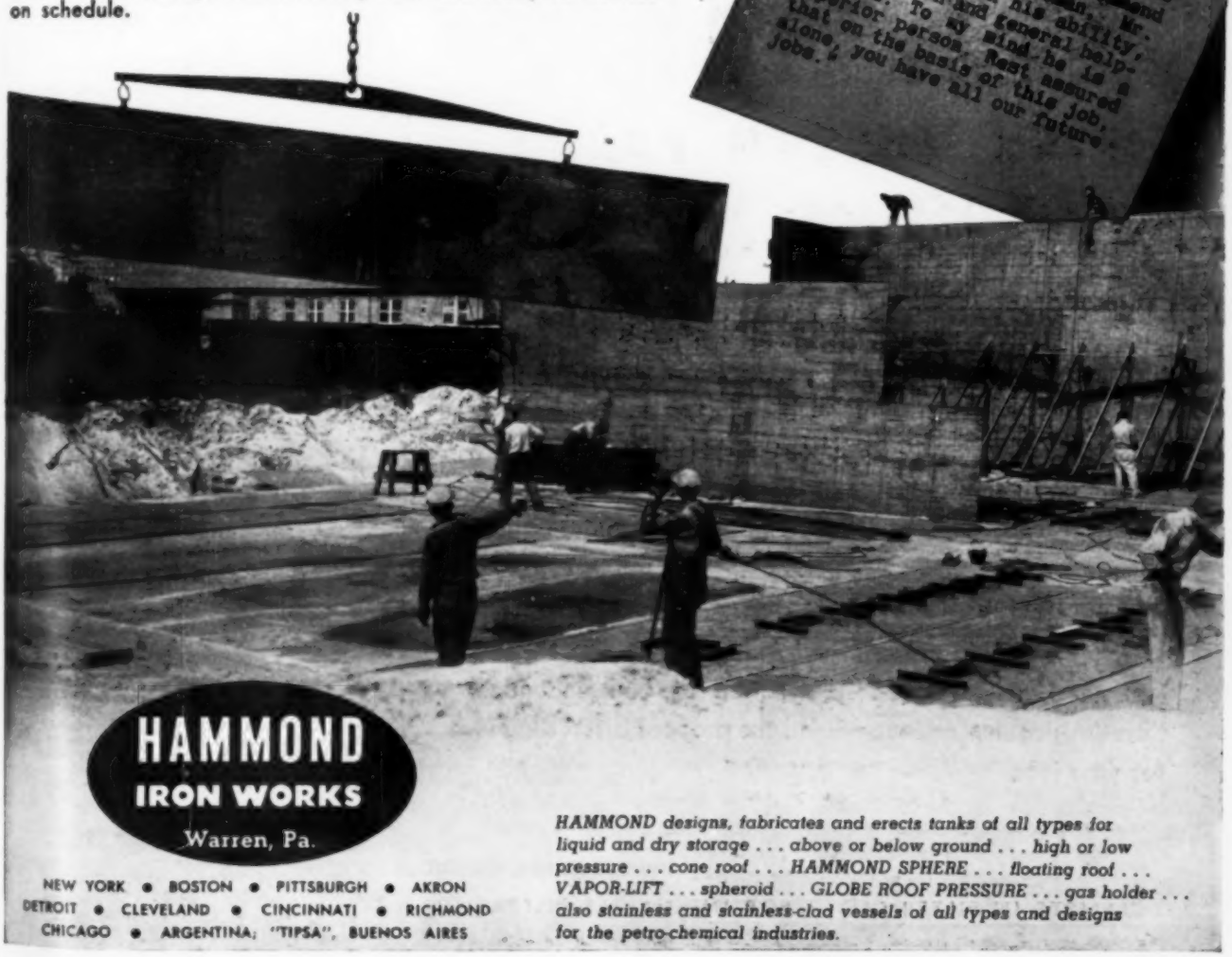

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Toledo, Ohio—4-page leaflet illustrating and describing the tempering furnaces made by this company.

26

Industrial Clothing. Archer Rubber Co., Milford, Mass.—8-page catalog of the industrial work clothing manufactured by this company.

27

Industrial Clothing. Hydro-Tex Corp., Chicago, Ill.—4-page leaflet illustrating and describing the plastic industrial aprons equipped with permanently fused all-plastic eyelets made by this company.

28

Industrial Flooring. Walter Maguire Co., Inc., New York, N. Y. Bulletin No. 603 features the use of Emeri-Crete Fooring for use in various industrial plants.

29

Instruments. Bell Telephone Laboratories, New York, N. Y.—Monograph B-1376 is a four page reprint entitled "A Simple Refractoscope for Liquids."

30

Instruments. Fuller Co., Catasauqua, Pa.—Bulletin 1-3 entitled "Fuller Material-Level Indicator for Storage Bins and Silos" contains six pages which illustrate and describe this piece of equipment.

31

Instruments. Leslie Co., Lyndhurst, N. J.—Bulletin 464, 22-page booklet illustrating and describing the temperature regulators and controllers made by this company. Includes data on the self-contained temperature regulators and the external pilot-operated temperature controllers made by this company. Contains information on size and capacity tables, as well as instruction for installation, operation, Maintenance, etc.

32

Insulated Cable. Hazard Insulated Wire Works, Wilkes-Barre, Pa.—Bulletin H-407 contains six pages describing this company's aluminum building wire. Bulletin 302-AL contains list prices as of Jan. 1, 1947.

33

Insulation. Monsanto Chemical Co., St. Louis, Mo.—4-page leaflet featuring Santocel, this company's insulation material for refrigeration equipment.

34

Kettle Heating System. Blaw-Knox Div. of Blaw-Knox Co., Pittsburgh, Pa.—Bulletin 2083. 8-page booklet illustrating and describing the electrovapor heating system which combines the advantages of electrical and Dowtherm heating for use in the chemical and process industries. A number of applications are suggested. Diagrammatic flowsheet shows application to a resin kettle installation.

35

Lighting. Lustra Corporation of America, New York, N. Y.—Bulletin No. 103 is a four-page leaflet describing four types of light bulbs especially designed for heavy-duty service where ordinary light bulbs fail to stand up.

36

Materials Handling. Elwell-Parker Electric Co., Cleveland, Ohio—New illustrated catalog describes the various types of power industrial trucks and cranes manufactrued by this company. Principal specifications are given.

37

Materials Handling. Lift Trucks, Inc., Cincinnati, Ohio—6-page illustrated leaflet describing the Hydro-Lectric lift truck available from this company. Details of construction are shown by sketches and photographs.

38

Materials Handling. Lyon-Raymond Corp., Greene, N. Y.—Bulletin No. 220 is a 4-page booklet illustrating and describing the hydraulic pallet lift truck manufactured by this company. Construction and operation is shown by photographs and sketches.

39

Petroleum Products. Phillips Petroleum Co., Bartlesville, Okla.—8 x 24-in. chart entitled "Vapor Pressures of Twelve Four-Carbon-Atom Hydrocarbons." Vapor pressures 0.30 to 800 lb. per sq. in. absolute are shown over a temperature range of —110 to +320 deg. F. Includes such hydrocarbons as isobutane, isobutylene 1, 3-butadiene, vinyl acetylene, etc.

40

Petroleum Products. Sun Oil Co., Philadelphia, Pa.—4-page folder listing and describing the various oils, greases and other industrial products manufactured by this company.

41

Plastic Dip Tanks. Aeroil Products Co., West New York, N. Y.—Two-page flyer illus-

TAKE YOUR CHOICE...

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Looking for the "outside suspension" cleaner that will clean your tubes faster . . . protect them longer? The Wilson Trigger Power Cleaner, and the Wilson Pistol Grip, for tubes as small as ¼" I.D. are convenient, rugged production tools that will make quick work of cleaning small tubes in your heat exchanger equipment.

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Remember, too, that the Wilson Trigger Power tube cleaner is the *only* tube cleaner with which it is economically practical to remove deposits from completely plugged tubes without damage to the tube walls—that the Wilson Pistol Grip weighs only 3 lbs. (no more than a 12" Stillson wrench) providing the operator with one hand control for cleaning small, straight tubes of ¼" to 1" I.D. in sterilizers, hot water heating units, lube oil heaters, oil preheaters, and heat exchangers.

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TUBE CLEANERS

trating and describing various models of dip tanks for application of plastic coatings to various types of objects. Discusses temperature control.

42

Rubber-Lined Piping. The B. F. Goodrich Co., Akron, Ohio—Catalog Section 9780, 8-page folder featuring Vulcalock rubber lined pipe and fittings made by this company. The various types of fittings are illustrated, and the different linings available are listed. Includes information on how to apply gaskets to these fittings and describes rubber expansion joints for pipe lines.

43

Safety Equipment. American Optical Co., Southbridge, Mass.—Now available from this company is a body safety guide which classifies occupational hazards by industries and recommends the proper safety clothing and equipment for maximum protection. Classifies 21 hazardous types of work found in 18 industries.

44

Safety Equipment. Mines Safety Appliances Co., Pittsburgh, Pa.—4-page illustrated leaflet featuring the carbon monoxide alarm designed for efficient protection against dangerous concentrations of carbon monoxide in the air. Principle of operation is described and a wiring diagram and cutaway view of the instrument is shown. Bulletin DR 3.

45

Steam Specialties. Jerguson Gage & Valve Co., Somerville, Mass.—General catalog illustrating and describing the liquid level gages, valves and engineering specialties available from this company.

46

Synthetic Rubber Insulation. Simplex Wire & Cable Co., Cambridge, Mass.—12-page booklet on Simplex synthetic rubber insulation. Discusses natural and synthetic rubber insulation materials, principal synthetic compounds, and describes the various types of synethic rubber insulation made by this company. Properties of the different classes of insulation are given in tabular form.

47

Tank Roof. Graver Tank & Mfg. Co., Inc., East Chicago, Ind.—8-page illustrated booklet describing the expansion roof and the improved floating roof of double-deck construction which prevents vapor losses in the storage of petroleum products. Cross-sectional views illustrate the principles involved. Includes data on construction features, design features, accessories. Applications are discussed and the advantages outlined.

48

Temperature Indicator. Tempil Corp., New York, N. Y.—6-page illustrated folder describing the fusible temperature indicator manufactured by this company. Covering a range of 125 to 1,700 deg. F., these indicators are available in liquid, crayon or pellet form, and have a sharp and rapid melting action at the specified temperatures.

49

Valves. Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.—4-page folder featuring various types of control valves made by this company. Includes information on water pressure reducing valves, single-acting standard altitude valves, integral pilot type cold water float valves, water strainers, etc. Valves are illustrated by cutaway views and applications are shown in diagrammatic sketches.

50

Water Treating. Liquid Conditioning Corp., New York, N. Y.—Catalog G. 56-page booklet illustrating and describing the various types of water-conditioning processes and explains the applications, advantages and limitations of each types. Included are tables listing the various kinds of gaseous and solid impurities, showing the effects, limits of tolerance for various purposes, methods of removal, and residual amount of each impurity after treatment. Also Bulletin 2 of four pages featuring the deaerating heaters and vacuum deaerators manufactured by this company.

51

Welding. Ampco Metals, Inc., Milwaukee, Wis.—Bulletin D-2383. 19-page mimeographed loose leaf compilation entitled "Weldability and Composition of 313 Copper-Based Alloys." Gives trade names, manufacturers, and chemical composition of the established copper-based alloys, together with welding information such as degree of weldability, preheat, type of electrodes or rods recommended together with the preferred welding process.

52

Welding. Arcos Corp., Philadelphia, Pa.—4-page leaflet illustrating and describing the Oxyarc process for cutting various types of metals with the combination of an electric arc and a stream of oxygen.

CHEMICAL ECONOMICS

H. M. Ballers, MARKET EDITOR

ACTIVITIES IN MOST LARGE MANUFACTURING LINES WERE SPEEDED UP SHARPLY IN JANUARY

SHIPMENTS OF goods from manufacturing plants continued to rise in December with the value of delivered products reported at $12.7 billion or a gain of about 2 percent over the total for the preceding month. That a much higher level was reached in January is indicated by reports that many of the more important manufacturing lines operated at a much higher rate in that month. Steel mills operated at about the same level as in last October which was the peak month for that industry in 1946. Automotive outputs were up appreciably, paper mills moved up rates of activities, oil refineries were less active in the first half of the month but became more active in the closing weeks and while total runs to stills were under the December figure, they were about 5 percent above those reached in January 1946. These are typical of the preliminary reports obtained from other manufacturing lines and apparently manufacturing outputs in general, as well as consumption of raw materials, went through the opening month of the year in a gratifying way.

While data for all segments of the chemical industry are not yet at hand, it is probable that the general movement in January was along lines reported for all manufacturing. In most branches production was said to be at capacity but the use of that term is relative since much of present-day equipment is far from 100 percent efficient and current capacities frequently are not large enough to fill requirements. Because of the publicity given in recent months to the shortage of soda ash, the position of that chemical will illustrate the wide influence such a scarcity has upon production totals. In the first place, while production has fallen from the wartime peak, it still is far ahead of prewar volume. Hence, growth in consuming demand is the reason underlying the shortage. The shortage itself is cutting down production on many chemicals, it is restricting operations in many consuming industries, such as glass, soap, textiles, alumina, and water softeners.

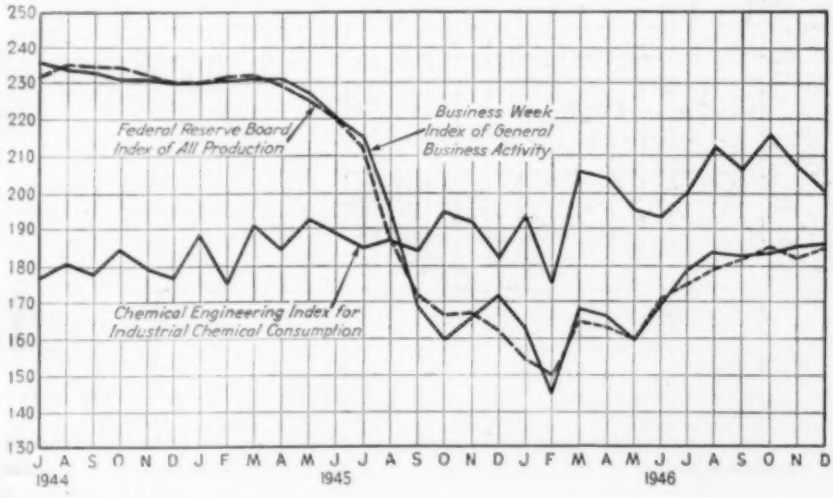
What is true of soda ash applies in varying degrees to caustic soda, phenol, solvents, and many other basic chemicals. The importance of this lies in the fact that productive activities can expand only so far as availability of raw materials makes it possible. That relatively high levels were reached in January is encouraging but many production schedules and plans for nearby plant expansions must now give more than usual consideration to the problem of covering raw material requirements.

All production as measured by the index of the Federal Reserve Board, dropped rather sharply in the closing weeks of last year. The index for November stood at 182 with 176 representing activities in December. For production of industrial chemicals the Board places the index at 411 in November and at 417 in December. The *Chemical Engineering* index for industrial consumption of chemicals followed the line of all production and dropped 200.54 in December with 206.60 as the revised figure for November. Seasonal influences had something to do with the drop in December but the coal strike in the latter part of November and early part of December had a direct effect on some producing plants and an almost equally direct effect on others by curtailing their raw material supplies. The strike at a southern alkali plant also was a factor in the decline in rayon output for the month. Production of glass containers and flat glass still is restricted because of the shortage in soda ash.

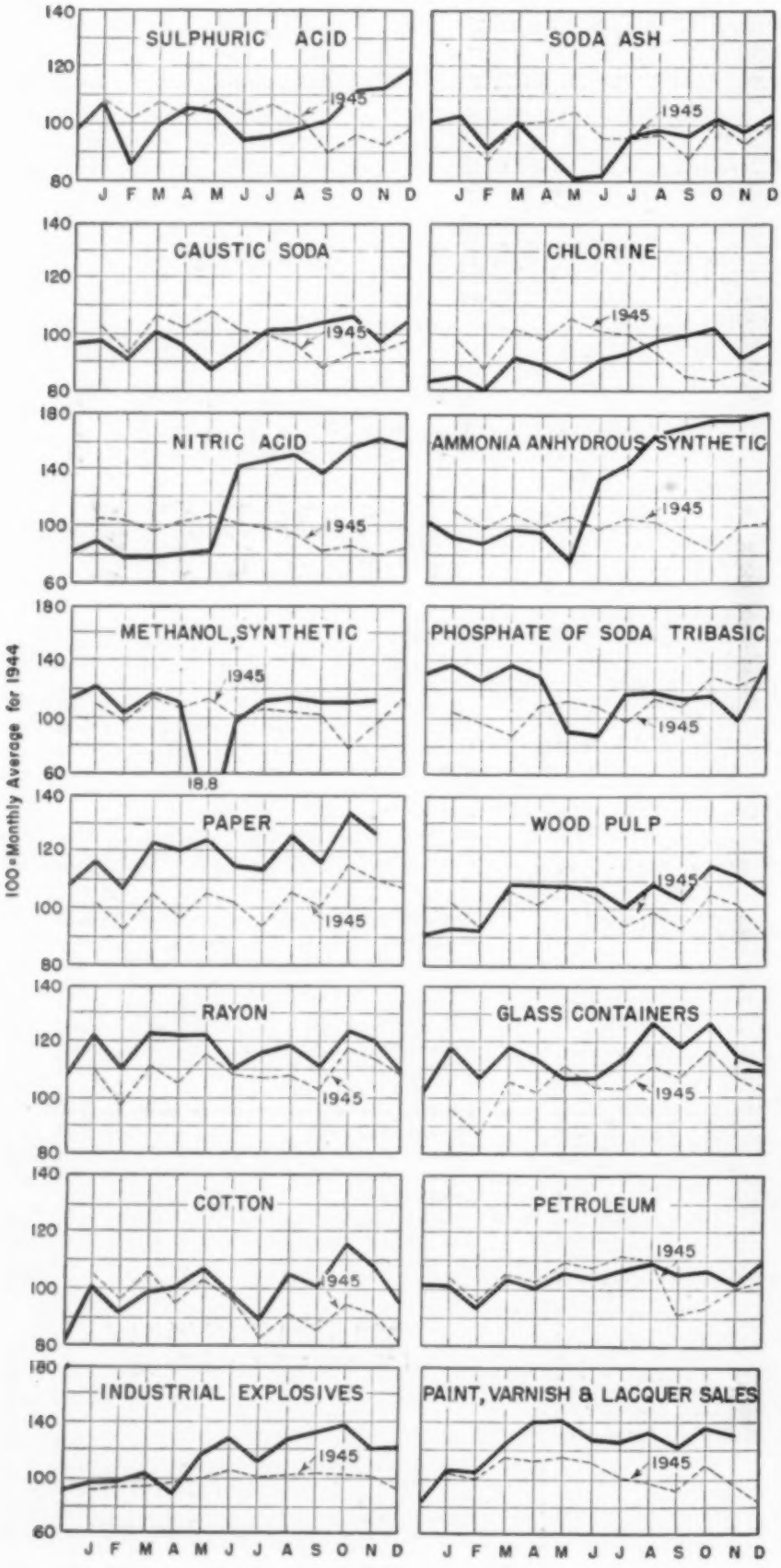
Plastics was among the divisions which made a favorable showing in December. Practically all types of plastics shared in the more active movement with cellulose acetate, phenolic, polystyrene, and vinyl recording the highest gains over the November totals. Shortage of some of the important materials, however, is still reported and this tended to delay plans for expansion of plants for molding and fabricating plastics. Refiners of petroleum also were more active in December but production of vegetable oils fell off because the drop in crush of cottonseed more than offset the increase in consumption of copra, soybeans, and peanuts. Crushing of linseed also was lower in December.

***Chemical Engineering* Index**
Industrial Consumption of Chemicals

	Nov. Revised	Dec
Fertilizers	46.53	47.30
Pulp and paper	22.33	20.77
Petroleum refining	18.32	19.53
Glass	21.88	20.40
Paint and varnish	21.72	20.60
Iron and steel	11.81	10.27
Rayon	20.39	18.37
Textiles	11.70	10.57
Coal products	8.85	7.70
Leather	4.45	4.50
Explosives	6.63	6.60
Rubber	6.45	6.60
Plastics	6.54	7.33
	206.60	200.54



PRODUCTION AND CONSUMPTION TRENDS



PRICE CHANGES in the market for chemicals are predominantly on the up side. Very little softness is reported in current trading and while many important chemicals appear to be maintaining a steady and well established position, others in the last month have moved up to higher sales levels. Demand is running heavy and price advances in general are due either to the excess of demand over supply or to rising costs for raw materials. It had been anticipated that metal derivatives would fluctuate for some time in harmony with fluctuations in metals and this has proved to be the case for such items as lead, zinc, and copper salts, all of which have been subjected recently to upward price adjustments. There even is a possibility that sulphur will sell at higher figures. A bill has been introduced in the Texas Legislature, which, among other things, proposes that the present severance tax of $1.27 a long ton on sulphur be raised to $5 a ton. It is not probable that the proposal, at least as now drawn, will be adopted.

Around the middle of last month it was announced that export controls had been lifted on rosins. This had the immediate effect of stimulating interest on the part of exporters and also had a strengthening effect on prices. Some drop from the high points followed but the market can hardly be called stabilized.

In domestic trade, considerable variations are noted in the volume of rosin passing to the different consuming industries. Soap makers have cut their requirements partly because they no longer are obliged to use a specified percent of rosin in their finished product and partly because production of soap has been reduced because of short supplies of oils and fats. More rosin is going into linoleum but here again the shortage of oils is an unfavorable factor and it will be some time before lineoleum production can be raised to a point where it will take care of consuming needs. Paint and varnish makers have increased their demands but ester gums and synthetic resins are competing actively in this industry. For the first half of the current season paper makers held the ranking place as consumers of rosin and will consume more than 15,000 tons more in 1946-47 than they did in 1945-46. Manufacturers of chemicals and pharmaceuticals probably will increase their requirements by about an equal figure.

BEFORE ordering condenser tubes

CONSULT REVERE

USERS of condenser tubes naturally are interested in obtaining tubes that will last long, because that means economy. However, the life of a tube may depend only in part upon the alloy of which it is made. For that reason Revere is always glad to make a thorough study of all the conditions of use when tubes have to be replaced oftener than they reasonably should. This extra service offered by Revere often adds greatly to economy.

For example, there was the case of a refinery where tubes in a heat exchanger were failing within a year. A study of temperatures and other operating conditions showed that changing to Admiralty tubes would result in sufficiently longer life to more than pay for the slightly higher cost. During examination of the exchanger it was found that the tubes showed considerable pitting at the inlet side of the hot vapors. Use of a baffle plate at this point was suggested. The superintendent followed both recommendations, and when last checked, the equipment had given 20 months of completely satisfactory service and was still in operation.

Revere suggests you go over your records, and ask for collaboration on any cases of uneconomical performance of condenser tubes.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

• • •

Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p.m., EST.

END USES FOR CHEMICALS

THE BUREAU of the Census has released further data showing end uses of chemicals based on allocation records of the War Production Board. The data with the periods covered are:

Hydrogen Peroxide

(100 Volume Basis)

July 1, 1944–June 30, 1945

Use	1,000 lb.	Percent
Total allocations	29,440	100.00
Direct military	8,535	29.0
Export	234	0.8
Other uses	20,671	70.2
Textile processing	10,402	35.3
Chemical processing	2,727	9.3
Drugs and cosmetics	1,155	3.9
Fur treatment	517	1.8
Bleaching	270	0.9
Resale and small orders *	3,829	13.0
Miscellaneous †	1,771	6.0

* Distributed to "Other uses." † Includes quantities for foods, gelatin, lanolin, lecithin, and soap processing.

Precipitated Barium Carbonate

July 1, 1944–June 30, 1945

Use	Tons	Percent
Total allocations	21,261	100.0
Direct military	7,888	37.1
Export	88	0.4
Other uses	13,287	62.5
Ceramic brick and clay	4,184	19.7
Chemicals	2,187	10.3
Glass manufacturing	1,882	8.9
Metal heat treating	2,053	9.6
Oil well drilling	2,015	9.5
Miscellaneous	966	4.5

Potassium Chlorate

January 1, 1944–June 30, 1945

Use	1,000 lb.	Percent
Total allocations	35,478	100.0
Direct military	4,636	13.0
Export	3,746	10.6
Other uses	27,106	76.4
Matches	25,142	70.9
Chemical heat packs	742	2.1
Commercial explosives	504	1.4
Pharmaceuticals and medicinals	99	0.3
Miscellaneous	619	1.7

Anhydrous Hydrofluoric Acid

(100 Percent H_2F_2)

July 1, 1944–June 30, 1945

Use	Tons	Percent
Total allocations	33,050	100.0
Direct military	5,711	17.3
Other uses	27,339	82.7
Aviation gasoline	13,083	39.6
Chemical uses	2,086	6.3
Miscellaneous	12,170	36.8

Lactic Acid

October 1, 1944–March 31, 1945

Use	1,000 lb.	Percent
Total allocations	5,899	100.0
Direct military	2,792	48.7
Export	179	3.0
Other uses	3,428	58.3
Food processing	592	10.0
Leather processing	506	8.6
Beverages	413	7.0
Plastics	153	2.6
Textile processing	114	1.9
Adhesives	93	1.6
Sodium lactate	79	1.4
Medicinals and pharmaceuticals	22	0.4
Miscellaneous	1,456	22.8

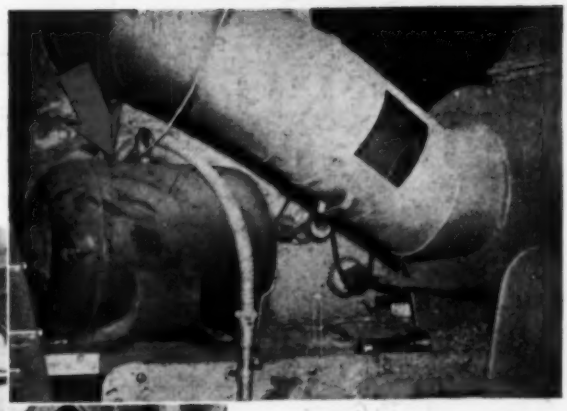
Sodium Bichromate

January 1, 1944–June 30, 1945

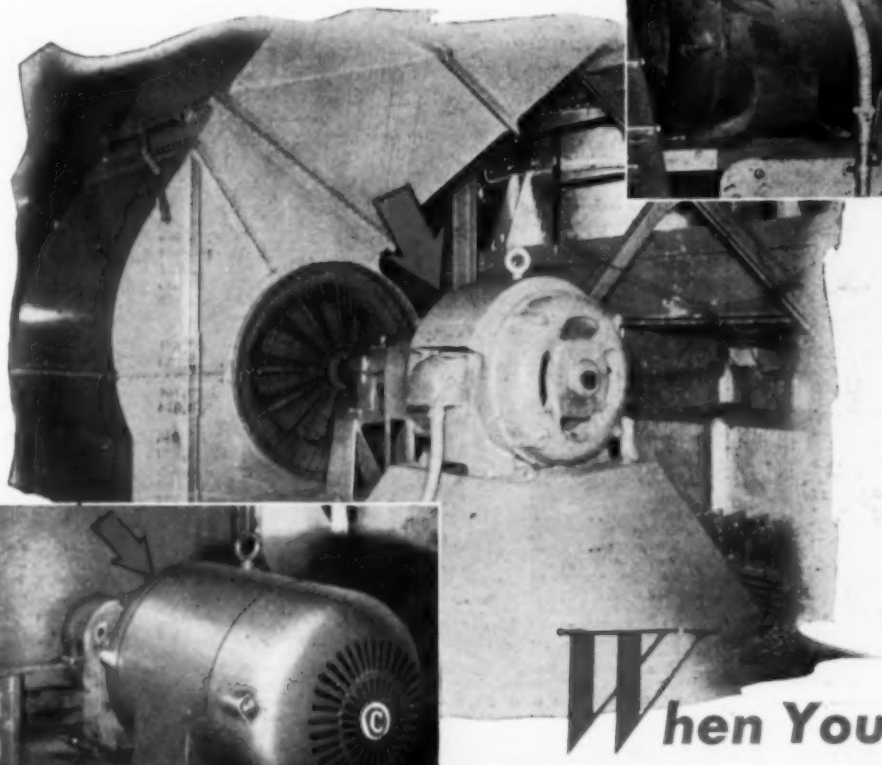
Use	1,000 lb.	Percent
Total allocations *	192,950	100.0
Export	3,407	1.8
Other uses	189,553	98.2
Pigments	82,222	42.6
Chemical manufacture *	30,353	15.8
Tanning	30,076	15.6
Metallurgical uses	15,964	8.2
Metal treatment	13,844	7.1
Corrosion prevention	2,120	1.1
Textile processing	11,661	6.0
Miscellaneous †	19,278	10.0

* Excludes sodium bichromate used in the manufacture of other primary chromium chemicals. † Includes metal alloys.

You Can Forget About Atmospheric Hazards



This 5 horsepower Century motor operates a conveyor in a grain elevator in an atmosphere charged with explosive dust.



Because this Century 200 horsepower motor operates a blower in the boiler house of a large generating plant it is *protected from falling objects* and dripping liquids.

In this installation the 15 horsepower Century motor is *totally enclosed fan cooled* because it operates in an atmosphere charged with corrosive fumes that would attack the vital parts of the motor.

When You Have a CENTURY Protected Motor *...Properly Applied*

WITH the correct Century motor driving your machine you can have complete confidence that it will provide a long life of satisfactory performance.

From the wide range of standard types and sizes there is a Century motor that will meet the electrical characteristics and atmospheric conditions of nearly every application.

The three examples shown here each require a different kind of motor frame because of the differences in surrounding conditions. In addition to the fact that all three are powered by Century motors — they have other things in common. They are quiet starting, and they run smoothly and quietly due to their unusual freedom from vibration. They have the correct electrical characteristics to give top performance.

Century builds a complete line of electric motors and generators, fractional and integral horsepower, in the popular sizes to meet the requirements of appliances, industrial production and commercial needs.

Specify Century for all your electric power applications.

Century C MOTORS

CENTURY ELECTRIC COMPANY • 1806 Pine Street • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

520

United States Production of Certain Chemicals

November 1946, November 1945 and Eleven-Month Totals for 1946 and 1945

Chemical (Tons unless otherwise noted)	November 1946	November 1945	Total, Eleven Months 1946	Total, Eleven Months 1945
Ammonia, synthetic, anhydrous[1]	80,380	45,298	643,414	503,198
Ammonium nitrate (100% NH_4NO_3)	81,733	39,678	641,133	.....
Ammonium sulphate, synthetic, technical[2]	26,021	16,015	198,780	.....
Calcium arsenate (100% $Ca_3(AsO_4)_2$)[3]	1,330	1,403	34,903	25,644
Calcium carbide, commercial	55,312	44,610	518,308	628,707
Calcium phosphate:[4]				
Monobasic (100% $CaH_4(PO_4)_2$)	7,109	6,793	68,099	57,550
Dibasic (100% $CaHPO_4$)	5,624	7,518	63,880	50,931
Carbon dioxide:[4]				
Liquid and gas	15,437	16,412	201,144	196,988
Solid	46,611	42,856	603,827	624,536
Chlorine	97,186	91,453	1,062,742	1,097,289
Chrome green (C.P.)[3]	1,265	1,527	16,711	7,455
Chrome yellow and orange (C.P.)[3]	3,053	4,773	39,998	39,537
Hydrochloric acid (100% HCl)	30,180	30,037	310,912	378,561
Hydrogen[5]	1,525,000	1,414,000	16,124,000	.....
Lead arsenate, acid and basic[4]	2,865	4,253	52,943	65,943
Molybdate chrome orange (C.P.)[3]	435	339	4,203	1,544
Nitric acid (100% HNO_3)	63,277	31,352	511,357	414,049
Oxygen[5]	1,005,544	875,350	9,838,259	13,035,460
Phosphoric acid (50% H_3PO_4)	82,419	70,409	787,796	649,628
Soda ash:				
Ammonia-soda process:				
Total wet and dry[2]	368,302	355,039	3,898,862	3,995,231
Finished light[2]	176,446	177,737	1,993,288	2,088,044
Finished dense	136,626	123,237	1,405,716	1,315,379
Natural[4]	15,357	15,283	191,790	167,146
Sodium bicarbonates	15,580	15,692	182,946	158,135
Sodium bichromate and chromate	7,159	6,999	78,808	73,903
Sodium hydroxide:				
eectrolytic process:				
Liquid[5]	92,531	85,616	1,029,585	1,038,957
Solid	13,848	16,073	177,997	196,900
Lime-soda process:				
Liquid[5]	60,751	62,516	677,943	671,991
Solid	20,374	20,340	215,544	223,521
Sodium phosphate:				
Monobasic (100% NaH_2PO_4)	986	1,307	10,771	13,603
Dibasic (100% Na_2HPO_4)	5,676	5,528	53,931	55,160
Tribasic (100% Na_3PO_4)	6,596	8,299	98,217	80,021
Meta (100% $NaPO_3$)	2,012	2,749	24,937	25,396
Tetra (100% $Na_4P_2O_7$)	4,428	4,104	62,658	39,179
Sodium silicate	34,442	28,843	379,645	381,458
Sodium sulphate:				
Anhydrous	9,229	9,530	163,107	75,994
Glaubers salt[4]	15,242	13,712	162,258	182,449
Salt cake, crude, commercial	37,239	53,387	425,438	512,890
Sulphuric acid:[7]				
Chamber	526,859	402,363	5,103,680	5,099,979
Contact, net[8]	274,909	235,853	2,788,449	2,906,631
Zinc yellow	203	205	13,296	13,318

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given, data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Includes oleum grades, excludes spent acid. [7] Data for sulphuric acid manufactured as a byproduct of smelting operations are included. [8] Thousands of pounds. [9] Thousands of cubic feet.

United States Production of Certain Synthetic Organic Chemicals

October 1946, October 1945 and Ten-Month Totals for 1946 and 1945

	October 1946	October 1945	Total, Ten Months 1946	Total, Ten Months 1945
Acetanilid	1,134,531	.....	.....	.....
Acetic acid:				
Synthetic[1]	24,980,326	16,437,682	228,540,826	218,428,198
Recovered	110,563,661	60,521,711	973,511,121	.....
Natural[2]	2,806,758	2,235,000	23,365,435	28,050,671
Acetic anhydride[3]	46,376,409	38,534,998	428,243,678	435,720,436
Acetone	25,975,688	17,321,940	270,560,257	.....
Acetylsalicylic acid	710,143	1,010,823	7,877,585	8,983,788

(*Continued on page 308*)

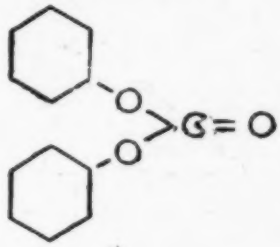
Another Basic Organic Chemical for American Industry...

diphenyl carbonate

(CARBONIC ACID, DIPHENYL ESTER)

by GENERAL CHEMICAL COMPANY

Structural Formula:



Physical Properties:

Appearance: white crystalline solid, white needles from alcohol.

Molecular Weight: 214.

Melting Point: 78° C.

Boiling Point: 302° C.

Specific Gravity:
Liquid 1.122 at 87° C.
Solid 1.272 at 14° C.

Chemical Properties:

1. Can be halogenated and nitrated in characteristic manner.

2. Readily undergoes hydrolysis and ammonolysis when treated respectively with inorganic bases, ammonia and amines.

Solubilities:

Insoluble in water.

Quite soluble in acetone, hot alcohol, benzene, carbon tetrachloride, ether, glacial acetic acid, and many other organic solvents.

Fundamental research and product development in today's chemical process industries constantly require new chemical tools of varying properties. Perhaps your investigations indicate the need for a process material with the characteristics of General Chemical Company's Diphenyl Carbonate. If so, experimental quantities of this basic organic chemical are available on request to General Chemical Company, Research and Development Division, 40 Rector Street, New York 6, N. Y.

With Diphenyl Carbonate in commercial production, General Chemical Company can supply your needs all the way from laboratory research to full scale operations ... an important consideration when you investigate any material for product development.

GENERAL CHEMICAL COMPANY
40 RECTOR STREET, NEW YORK 6, N. Y.

Sales and Technical Service Offices: Albany • Atlanta • Baltimore • Birmingham • Boston Bridgeport • Buffalo • Charlotte • Chicago • Cleveland • Denver • Detroit • Houston Kansas City • Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh Providence • San Francisco • Seattle • St. Louis • Wenatchee & Yakima (Wash.)
In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

BASIC CHEMICALS
GENERAL CHEMICAL COMPANY
FOR AMERICAN INDUSTRY

U. S. Production of Synthetic Organic Chemicals (Cont. from page 306)

	October 1946	October 1945	Total, Ten Months 1946	Total, Ten Months 1945
Aniline	8,924,437	6,468,661	73,197,358	.....
Barbituric acid derivatives:[1]				
5-ethyl-5-phenylbarbituric acid and salts (Phenobarbital)	29,683	29,747	321,561	238,027
Benzene:				
Motor grade:				
Tar distillers[4]	810,345	376,890	7,787,673	.....
Coke-oven operators[5]	3,099,533	4,043,615	26,055,862	.....
All other grades:				
Tar distillers[4]	1,208,588	3,473,047	17,260,366	.....
Coke-oven operators[5]	11,208,111	7,083,220	86,225,897	.....
Butyl alcohol, primary, normal	8,670,507	5,906,393	[12]86,491,753	.....
Carbon bisulphide	27,444,008	23,261,284	247,981,905	.....
Carbon tetrachloride	16,537,880	11,136,450	122,360,970	.....
Chlorobenzene, mono	22,360,088	16,115,518	220,853,450	.....
Creosote oil:				
Tar distillers[4]	12,202,721	10,391,451	108,245,347	106,684,492
Coke-oven operators[5]	4,148,976	3,158,667	23,150,708	30,147,160
Cresols:[7]				
Meta-para	414,783	470,027	4,798,875	6,826,282
Ortho-meta-para	532,095	617,702	.....	7,682,633
Cresylic acid, refined[7,11]	2,455,799	2,132,956	19,849,191	24,543,386
Dibutyl phthalate	1,481,857	.....	.....	.....
Dichlorodiphenyltrichloroethane (DDT)	3,788,544	3,071,468	37,091,003	.....
Ethyl acetate (85% by wt.)	6,744,934	7,329,352	75,992,991	89,646,171
Ethyl ether, technical and U.S.P.	3,003,670	2,963,871	30,372,197	67,883,603
Formaldehyde (37% by wt.)	41,863,814	31,934,286	[12]379,153,711	.....
Methanol:				
Natural[8]	1,464,220	1,487,360	13,182,445	[12]15,746,056
Synthetic	43,776,937	31,445,934	404,123,256	408,445,214
Naphthalene:				
Tar distillers (less than 79°C.)	17,351,924	18,675,961	153,441,943	174,262,583
Tar distillers (79°C. and over)	8,752,881	7,670,410	80,135,940	62,535,772
Coke-oven operators (less than 79°C.)	6,425,254	5,631,640	57,257,632	73,541,707
Penicillin[9]	2,633,629	791,636	[12]21,731,932	.....
Phenol, synthetic and natural	18,369,252	15,565,258	161,233,410	.....
Phthalic anhydride	9,275,629	8,065,675	87,113,767	106,876,091
Styrene (government owned plants only)	29,960,223	21,872,141	310,577,842	.....
Toluene:				
Coke-oven operators[5]	1,466,888	1,450,263	13,439,520	.....
All others[10]	2,444,278	1,696,004	12,821,115	.....

All data in pounds except benzene (gal.), creosote oil (gal.), toluene (gal.), and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1] Excludes the statistics on recovered acid. [2] Acid produced by direct process from wood and from calcium acetate. [3] All acetic anhydride including that from acetic acid by vapor-phase process. [4] Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5] Statistics are given in terms of bulk medicinals only. [6] Statistics collected by Bureau of Mines. [7] Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8] Reported to U. S. Bureau of the Census. [9] Reported in gal. by Bureau of the Census but converted to lb. for comparison with the production of synthetic methanol. [10] Includes toluene produced from petroleum by any process. [11] Includes refined cresylic acid from petroleum. [12] Revised.

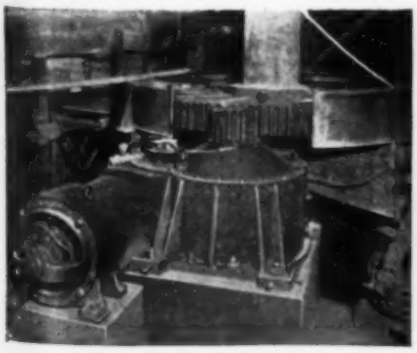
Jones

WORM-HELICAL SPEED REDUCERS

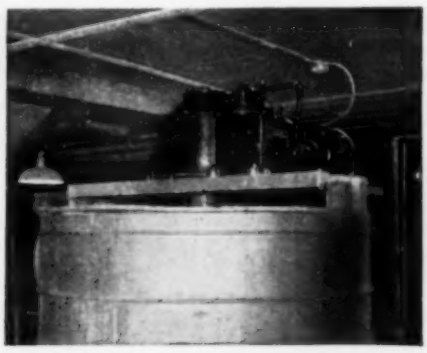
-for Vertical Shaft Drives

THESE machines fill a long felt need for double reduction units of the fully enclosed type to be used for agitators, mixers, ore roasters, bending rolls, etc., requiring a vertical shaft drive. Built in standard ratios in various types of assemblies ranging from 40 to 1 to 250 to 1 for all common motor speeds and a wide range of horsepower ratings.

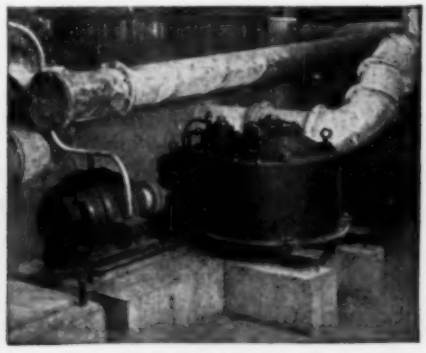
Jones Bulletin No. 75 covers complete details on these Worm-Helical Speed Reducers, with rating tables, dimension diagrams, torque charts and other application information. We shall be pleased to send you a copy.



• Jones Worm-Helical Speed Reducer on ore roaster with section of dust guard removed to show final gear reduction.



• Jones Worm-Helical Speed Reducer driving a lacquer agitator. A simple design prevents leakage of oil along the vertical low speed shaft.



• Jones Worm-Helical Speed Reducer on a paper mill agitator drive.

W. A. JONES FOUNDRY & MACHINE CO., 4415 Roosevelt Road, Chicago 24, Illinois

CHEMICAL ENGINEERING Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	**123.41**
Last month	121.63
February, 1946	109.13
February, 1945	108.84

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to February 12.

INDUSTRIAL CHEMICALS

Acetone, tank, lb.	$0.07 –
Acid, acetic, 29% bbl., 100 lb.	3.78 – $4.03
Boric, bbl., ton	119.00 – 123.00
Citric, drums, lb.	.22½ – .23
Formic, cbys., lb.	.12 – .12½
Hydrofluoric, 30%, drums, lb.	.08 – .085
Lactic, 44% tech., light, bbl., lb.	.073 – .075
Muriatic, 18°, tanks, 100 lb.	1.05 –
Nitric, 36°, carboys, lb.	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb.	.13 – .14
Phosphoric tech., tanks, lb.	.0465 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb.	.54½ – .56
Alcohol, amyl from pentane, tanks, lb.	.15½ –
Alcohol, butyl, tanks, lb.	.14½ – .25
Alcohol, ethyl, denatured, No. 1 special, tanks, gal.	.82½ –
Alum, ammonia, lump, lb.	.04½ –
Aluminum sulphate, com. bags, 100 lb.	1.15 – 1.25
Ammonia, anhydrous, cyl., lb.	.14½ –
tanks, ton	59.00 – 61.50
Ammonium carbonate, powd., casks, lb.	.09½ – .10
Sulphate, wks., ton	30.00 –
Amyl acetate, tech. from pentane, tanks, lb.	.21 –
Aqua ammonia, 26°, drums, lb.	.02½ – .03
tanks, ton	65.00 –
Arsenic, white powd., bbl., lb.	.06 – .06½
Barium carbonate, bbl., ton	67.50 – 75.00
Chloride, bags, ton	80.00 – 90.00
Nitrate, casks, lb.	.09½ – .11
Blanc fixe, dry, bags, ton	67.50 – 72.50
Bleaching powder, f.o.b., wks., drums, 100 lb.	2.75 – 3.00
Borax, gran., bags, ton	48.50 –
Calcium acetate, bags 100 lb.	3.00 –
Arsenate, dr., lb.	.09 – .10
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	21.50 – 38.00
Carbon bisulphide, drums, lb.	.05 – .05½
Tetrachloride, drums, lb.	.06 – .06½
Chlorine, liquid, tanks, wks., 100 lb.	2.00 – 2.30
Copperas, bgs., f.o.b., wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb.	.23 – .24
Sulphate, bags, 100 lb.	7.10 – 7.25
Cream of tartar, bbl., lb.	.45 – .50
Diethylene glycol, dr., lb.	.14 – .15
Epsom salt, dom., tech., bbl., 100 lb.	2.05 – 2.25
Ethyl acetate, tanks, lb.	.09½ – .10½
Formaldehyde, 30%, tanks, lb., wks.	.032 –
Furfural, tanks, lb.	.09½ –
Glaubers salt, bags, 100 lb.	1.25 – 1.50
Glycerine, c. p., drums, extra, lb.	.55 – .60
Lead:	
White, basic carbonate, dry, casks, lb.	.14½ –
Red, dry, sck., lb.	.15½ –
Lead acetate, white crys., bbl., lb.	.17½ – .18
Arsenate, powd., bags, lb.	.20 – .21
Lithopone, bags, lb.	.05½ – .06
Magnesium, carb., tech., bags, lb.	.07½ – .08
Methanol, 95%, tanks, gal.	.60 –
Synthetic, tanks, gal.	.24 –
Phosphorus, yellow, cases, lb.	.22 – .25
Potassium bichromate, bags, lb.	.10½ – .10½
Chlorate, powd., lb.	.11 – .11½
Hydroxide (c'stic potash) dr., lb.	.07½ – .09½
Muriate, 60%, bags, unit	.53½
Nitrate, ref., bbl., lb.	.08½ – .21
Permanganate, drums, lb.	.20½ – .21½
Prussiate, yellow, casks, lb.	.19 – .20
Sal ammoniac, white, casks, 100 lb.	4.50 – 5.00
Salsoda, bbl., 100 lb.	1.10 – 1.20
Salt cake, bulk, ton	20.00 –
Soda ash, light, 58%, bags contract, 100 lb.	1.20 –
Dense, bags, 100 lb.	1.28 –
Soda, caustic, 76% solid, drums, 100 lb.	2.50 –
Acetate, del., lb	.05½ – .06
Bicarbonate, bags, 100 lb.	2.25 –
Bichromate, bags, lb.	.08 – .08½
Bisulphate, bulk, ton	20.00 – 24.00
Bisulphite, bbl., lb.	.03 – .04

CHEMICAL ENGINEERING

Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	**317.78**
Last month	303.82
February, 1946	145.63
February, 1945	145.63

Chlorate, kegs, lb	$0.06½	$0.06½
Cyanide, cases, dom., lb	.14½	.15
Fluoride, bbl., lb	.07	.08
Hyposulphite, bags, 100 lb	2.25	2.50
Metasilicate, bbl., 100 lb	3.40	4.00
Nitrate, bulk, ton	32.00	38.50
Nitrite, casks, lb	.06½	.07
Phosphate, tribasic, bags, 100 lb	3.50	.....
Prussiate, yel., bags, lb	.12	.12½
Silicate, 40°, dr., wks., 100 lb	.95	1.00
Sulphite, crys., bbl., lb	.02½	.02½
Sulphur, crude at mine, long ton	16.00	.....
Dioxide, cyl., lb	.085	.09
Dioxide, tanks, lb	.044	.....
Tin crystals, bbl., lb	nom.	
Zinc chloride, gran, bbl., lb	.05½	.06
Oxide, lead free, bags, lb	.09½	.09½
Oxide, 5% leaded, bags, lb	.09½	.09½
Sulphate, bags, cwt	4.15	7.00

OILS AND FATS

Castor oil, No. 3 dr., lb	$0.31½	.....
Chinawood, oil, tanks, lb	.39½	.....
Coconut oil, Ceylon, N. Y., lb	.21	.....
Corn oil crude, tanks (f.o.b. mill), lb	.30½	.....
Cottonseed oil crude (f.o.b. mill), tanks, lb	.31	.....
Linseed oil raw, car lots, dr., lb	.366	.....
Palm, casks, lb	nom.	
Peanut oil, crude, tanks (mill), bl	.30½	.....
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.27	.....
Menhaden, light, pressed, dr., lb	.29	.....
Crude, tanks (f.o.b. factory), lb	nom.	
Grease, yellow, loose, lb	.21	.....
Oleo stearine, lb	nom.	
Oleo oil, No. 1 lb	.26½	.....
Red oil, distilled, bbl., lb	.28½	.....
Tallow, extra, loose, lb	.21½	.....

COAL TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb	$0.58	$0.60
Alpha-naphthylamine, bbl., lb	.35	.36
Aniline oil, drums, lb	.12	.12½
Aniline salts, bbl., lb	.22	.24
Benzaldehyde, tech., dr., lb	.45	.50
Benzidine base, bbl., lb	.70	.75
Benzoic acid, USP, kegs, lb	.54	.56
Benzol, 90%, tanks, works, gal	.17	.....
Benzyl chloride, tech., dr., lb	.20	.21
Beta naphthol, tech., drums, lb	.23	.24
Cresol, USP, dr., lb	.13½	.....
Cresylic acid, dr., wks., gal	1.00	1.05
Diphenyl, bbl., lb	.16	.....
Diethylaniline, dr., lb	.48	.50
Dinitrotoluol, bbl., lb	.18	.19
Dinitrophenyl, bbl., lb	.22	.23
Dip oil, 15%, dr., gal	.23	.25
Diphenylamine, dr., f.o.b. wks., lb	.25	.....
H acid, bbl., lb	.50	.52
Hydroquinone, bbl., lb	.90	.95
Naphthalene, flake, bbl., lb	.09½	.10
Nitrobenzene, dr., lb	.08	.09
Para-cresol, bbl. lb	.41	.....
Para-nitroaniline, bbl., lb	.42	.43
Phenol, USP, tanks, lb	.10½	.11
Picric, acid, bbl., lb	.30	.32
Pyridine, dr., gal	1.55	1.60
Resorcinol, tech., kegs, lb	.68	.70
Salicylic acid, tech., bbl., lb	.26	.27
Solvent naphths, w.w., tanks, gal	.25	.....
Toluidin, bbl., lb	1.00	.....
Toluol, drums, works, gal	.22	.....
Xylol, com., tanks, gal	.22	.....

MISCELLANEOUS

Casein, tech, bbl., lb	nom.	
Dry colors:		
Carbon gas, black (wks.), lb	$.04	$.07
Prussian blue, bbl., lb	.42	.43
Ultramarine blue, bbl., lb	.13	.24
Chrome green, bbl., lb	.25	.40
Carmine red, tins, lb	5.50	6.00
Para Toner, lb	.80	.95
Vermilion, English, bbl., lb	2.60	2.70
Chrome yellow, C.P., bbl., lb	.24	.26
Gum copal, Congo, bags, lb	.09	.55
Manila, bags, lb	.09	.15
Damar, Batavia, cases, lb	.10	.22
Kauri, cases, lb	.18	.60
Magnesite, calc., ton	58.75	.....
Pumice stone, lump, bbl., lb	.05	.07
Rosin, H., 100 lb	11.50	.....
Shellac, orange, fine, bags, lb	.72	.....
Bleached, bonedry, bags, lb	.71	.....
T. N. bags, lb	.67	.....
Turpentine, gal	1.45	.....

NEW CONSTRUCTION

	Current Projects		Cumulative 1947	
	Proposed Work	Contracts	Proposed Work	Contracts
New England		$55,000	$55,000	$1,330,000
Middle Atlantic	$750,000	708,000	1,865,000	4,525,000
South		2,164,000	60,000	2,654,000
Middle West		705,000		1,652,000
West of Mississippi	10,000,000	23,332,000	20,251,000	25,542,000
Far West		478,000	1,765,000	1,264,000
Canada			315,000	
Total	$10,750,000	$27,442,000	$24,124,000	$36,967,000

Proposed Work

Pa., Roaring Springs—D. W. Bare Paper Co., Roaring Springs, plans to construct a 2 and 3 story factory and warehouse. Estimated cost $750,000.

Tex., Texas City—Carbon & Carbide Chemicals Corp., subsidiary of Union Carbide & Carbon Corp., New York, N. Y., plans to enlarge its plant here for the manufacture of plastics. Ford, Bacon & Davis, Texas City, Eng. Estimated cost $10,000,000.

Contracts Awarded

Ark., Clarksville—Eureka Brick & Tile Co., c/o E. K. Johnson, Clarksville, plans to construct a brick producing plant. Work will be done by owner. Estimated cost $200,000.

Calif., Los Angeles—Oro Chemical Co., 1018 South Santa Fe Ave., has awarded the contract for the construction of a factory to Fred Aldous, 8467 West Third St. Estimated cost $60,000.

Calif., Oakland—Pacific Rubber Co., 4901 East 12th St., has awarded the contract for a storage and shipping facilities building to Barrett & Hilp, 918 Harrison St., San Francisco. Estimated cost $165,000.

Fla., Jacksonville—General Chemical Co., 40 Rector St., New York, N. Y., will construct a sulphate plant with own forces. Estimated cost $260,000.

Ga., Augusta—Lily Cup Manufacturing Co., c/o Augusta Chamber of Commerce, has awarded the contract for a paper manufacturing plant to P. Kretzer & Sons, 32-15 Lawrence St., Flushing, N. Y. Estimated cost $1,500,000.

Md., Baltimore—Standard Oil Development Co., 500 North Broad St., Elizabeth, N. J., has awarded the contract for alterations and additions to its refinery to Consolidated Engineering Co., 20 East Franklin St., Baltimore. Estimated cost $150,000.

Minn., Hastings—Minnesota Mining & Manufacturing Co., 900 Fauquier Ave., St. Paul, has awarded the contract for a resin plant to W. Murphy & Son, 428 New York Bldg., St. Paul. Estimated cost $150,000.

N. J., Lyndhurst—Economics Laboratory, Inc., 914 Guardian Bldg., St. Paul, Minn., has awarded the contract for design and construction of a plant for the manufacture of a soapless cleaner, to Walter Kidde Constructors, Inc., 140 Cedar St., New York City. Estimated cost $65,000.

N. J., Trenton—Columbian Carbon Co., 601 Cass St., will construct a factory. Work will be done by separate contracts. Estimated cost $275,000.

O., Cleveland—Sherwin-Williams Co., Midland Bldg., has awarded the contract for a 3 story, 259x264 ft. and 2 story, 259x264 ft. warehouse to Albert M. Higley Co., 2936 East 22nd St. Estimated cost $450,000.

O., Youngstown—Republic Rubber Div. of Lee Rubber & Tire Corp., Albert St., has awarded the contract for a plant addition to George J. Murphy Construction Co., 519 Belmont Ave. Estimated cost $100,000.

Okla., Tulsa—Carter Oil Co., 1133 North Lewis St., has awarded the contract for an addition to its research laboratory to Marshall-Kerr Construction Co., 728 West 7th St. Estimated cost $225,000.

Ore., North Portland—Western Waxed Paper Co., Swift Blvd., North Portland, has awarded the contract for a 1 story, 66x85 ft. addition to its plant to Reimers & Jolivette, Railway Exchange Bldg., Portland. Estimated cost $81,000.

Ore., Portland—Lloyd A. Fry Roofing Co., 5818 Archer Rd., Summit, Ill., has awarded the contract for a 1 story factory here to Campbell, Lowrie, Lautermilch Corp., 400 West Madison St., Chicago, Ill. Estimated cost $172,000.

Pa., Chester—Scott Paper Co., foot of Market St., will construct a boiler house at its plant. Work will be done by separate contracts under supervision of Stone & Webster Engineering Corp., 49 Federal St., Boston, Mass. Estimated cost $1,500,000.

Pa., Connellsville—Anchor Hocking Glass Corp., Lancaster, has awarded the contract for a 1 story, 80x85 ft. addition to O. C. Cluss Lumber Co., Penna Ave., Uniontown. Estimated cost $55,000.

Pa., Natrona—Pennsylvania Salt Manufacturing Co., Natrona, has awarded the contract for a salt storage building to Unkefer Bros., Professional Bldg., Pittsburgh. Estimated cost $60,000.

Pa., Neville Island—Watson Standard Co., 225 Galveston Ave., Pittsburgh, Pa., has awarded the contract for a paint and varnish manufacturing plant to Landau Bros. Building Co., 128 First Ave., Pittsburgh. Estimated cost $60,000.

Pa., Philadelphia—Barrett Div. of Allied Chemical & Dye Corp., Margaret and Bermuda Sts., has awarded the contract for repairing its plant to Frank V. Warren, Inc., Lewis Tower Bldg. Estimated cost $98,000.

R. I., Providence—National Glass Co., Inc., 1645 Westminster St., has awarded the contract for a 1 story addition to its factory to Dimeo Construcion Co., 75 Wesminster St. Estimated cost $55,000.

Tex., Bishop—Celanese Corporation of America, Bishop, has awarded the contract for expanding chemical plant and constructing railway spur tracks to Tellepson Construction Co., 3900 Clay St., Houston. Estimated cost $65,000 and $72,000 respectively.

Tex., Brownsville—Carthage Hydrocol, Inc., G. C. Gabrielson, Pres., Brownsville, has awarded the contract for the construction of a gasoline manufacturing plant to Arthur G. McKee Co., 2300 Chester St., Cleveland, O. Hydrocarbon Research, Inc., 115 Broadway, New York, N. Y., Engr. Estimated cost $15,000,000.

Tex., Houston—Gulf Portland Cement Co., Shell Bldg., has awarded the contract for enlarging its plant to Stearns-Rogers Manufacturing Co., Union National Bank Bldg. Estimated cost $1,000,000.

Tex., Houston—Rohm & Haas Co., Ship Channel, has awarded the contract for chemical plant and warehouses to Foster-Wheeler Corp., 2501 Crawford St.. Estimated cost $1,200,000 and $200,000 respectively.

Tex., Houston—Rohm & Haas, 222 West Washington St., Philadelphia, Pa., has awarded a contract for additional plant construction for manufacturing chemicals, plastics, etc., to Foster-Wheeler Corp., 2501 Crawford St. Estimated cost $3,250,000.

Tex., Liberty—Texas Gulf Sulphur Co., Second National Bank Bldg., Houston, has awarded the contract for the construction of a sulphur plant to Consolidated Steel Corp., Oreange. Estimated cost $2,000,000.

Tex., Moss Hill (near Hardin)—Texas Gulf Sulphur Co., Second Natl. Bank Bldg., Houston, will construct two mining plant buildings and two plant additions. Work will be done by owner. Estimated cost $150,000.

Va., Fredericksburg—Sylvania Division of American Viscose Corp., Fredericksburg, has awarded the contract for an acid recovery building and river pump house to Hughes Foulkrod Co., 1505 Race St., Philadelphia, Pa. Estimated cost $55,000 and $98,668 respectively.

Wis., Brown Deer (Milwaukee P. O.)—Lakeside Laboratories, Inc., 1707 East North Ave., Milwaukee 2, has awarded the contract for a 1 story, 90x22 ft. and 40x40 ft. synthetic chemical laboratory to Peters Construction Co., 2640 North Humboldt Ave., Milwaukee. Estimated cost $100,000.

Wis., Rhinelander—Rhinelander Paper Co., Rhinelander, has awarded the contract for a 1 story, 156x365 ft. finishing room building and 1 story, 52x60 ft. filter building to C. R. Meyer & Sons Co., 50 State St., Oshkosh.